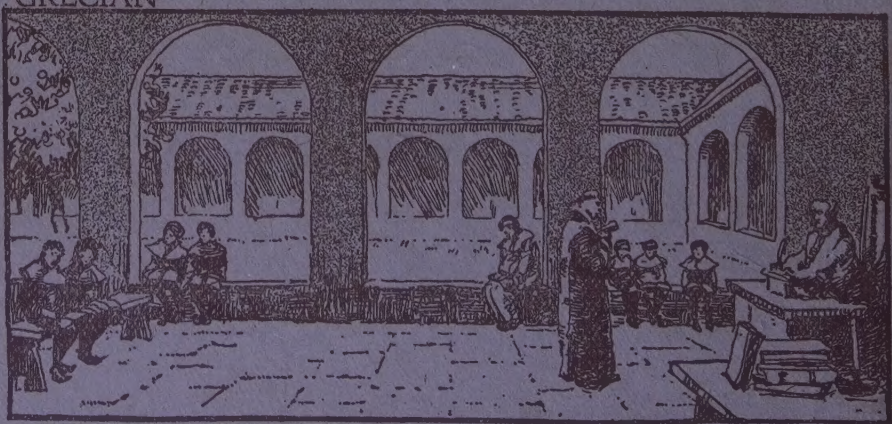
CHALDEAN

GRECIAN

THE FATE OF EMPIRES
DEPENDS UPON THE
EDUCATION
OF YOUTH

ARISTOTLE



MEDIEVAL

COLONIAL

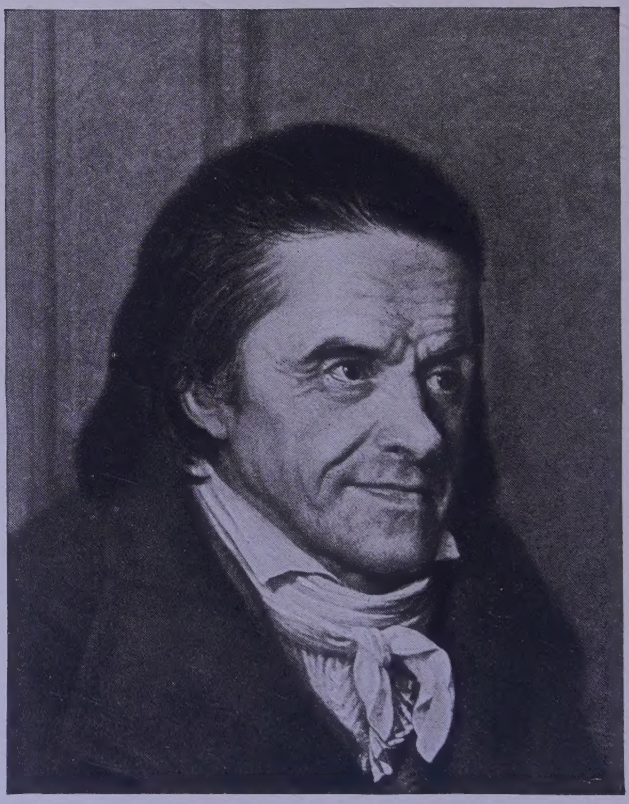
THE SECRET OF EDU
CATION LIES IN RE
SPECTING THE
PUPIL

EMERSON

PIONEER

MODERN

T.W. STEVENS



Johann Heinrich Pestalozzi

Force not the faculties of children into the remote paths of knowledge until they have gained strength by exercise on things that are near them.

—*Pestalozzi*

PUBLIC SCHOOL METHODS

New Edition

Fully illustrated from photographs, paintings and original drawings

VOL. II

1918

THE METHODS COMPANY

CHICAGO

Copyright, 1916: Hanson-Bellows Publishing Co.
All rights reserved

DEPARTMENTS BY VOLUME

Volume One

Kindergarten; Questions; Primary Reading; Questions; Plans; Primary Language; Questions; Plans; Story-Telling, Dramatization, Games, Songs; Questions; Construction Work; Questions.

Volume Two

Nature Study; Questions; Plans; Phonics; Questions; Number; Questions; Plans; Drawing; Picture Study; Spelling; Penmanship; Questions; Use of the Senses; Questions.

Volume Three

Geography (Primary); Questions; Plans; History (Primary); Questions; School and Environment; Schoolhouse and Grounds; Questions; Organization and Management; Questions; Discipline; Questions; Sanitation and Hygiene; Questions; Work of the School; Questions; Books and Libraries; Questions; Physiology; Questions; Physical Exercises; Character Building; Questions; Music; Special Day Programs (Primary Grades).

Volume Four

Reading; Questions; Plans; Language and Grammar; Questions; Plans; Geography; Questions; Plans; Elementary Science; Interesting Nature Lessons; Questions; Plans.

Volume Five

Arithmetic; Questions; Plans; History; Questions; Plans; Civil Government; Questions; Handcraft; Special Day Programs (Intermediate and Grammar Grades).

Volume Six

Agriculture; Questions; Plans; Construction Work; Questions; Music; Questions; Spelling; Questions; Penmanship; Questions; Adolescence; Psychology; Principles and Methods of Teaching; Questions; Drawing; Picture Study; Questions; Domestic Science; Questions.

The Teacher's Guide and Index

Vocational Guidance; Use of the Dictionary; Community Center; Thrift; Personal and Community Hygiene; Questions; Complete Index.

CONTENTS

CHAPTER ONE

Nature Study

FOREWORD PAGE

1. Educational Value 2
2. Qualifications of a Good Teacher 5
3. Equipment for the Teacher 6
4. Equipment for the Schoolroom 7
5. How to Use the Schoolroom Equipment 8
   (1) The Wall Table 8
   (2) A Terrarium 9
   (3) An Aquarium 13
   (4) A Cricket Cage 15
   (5) A Tripod Lens 15
   (6) Baskets 15
   (7) Flower Pots 15
   (8) A Teakettle and Spirit Lamp 16
   (9) Boxes 16
   (10) Cheesecloth 16
   (11) Garden Tools 16
   (12) For the Home 16

NATURE STUDY SUBJECT-MATTER

6. Nature on Every Hand for Study 17

I. *Natural Forces and Phenomena*

7. Sunshine; Shadow; Dawn; Twilight; Night 17
   "Summer Sun" 18
   "My Shadow" 19
8. Rain 20
9. Snow 22
   "The Little Artist" 23
10. Clouds 23
11. Wind 24
   "The Wind" 24
12. Sound 25

II. *Landscape Features*

13. What to Teach 25
14. A Type for Study 26

III. *Plant Study*

PAGE

15. Gardens 30
16. Plants for the School Garden 33
17. Interest in Soils 37
18. An Individual Plant 37
19. Trees 38
20. Weeds 42
    Daisy 43
    Wild Mustard 43
    Canada Thistle 44
    Orange Hawkweed 44
    Wild Morning Glory or Bindweed 45
    Dandelion 45
    Wild Carrot 45
    Lamb's Quarters 46
    Sheep Sorrel 46
    Quack Grass 47
    Weeds for Schoolroom Study 47
21. Grains and Grasses 47
22. The Autumn Harvest of Orchard and Garden 48
23. Wild Flowers 49

IV. *Animal Life*

24. Important to Understand Animals 49
25. Facts for Schoolroom Work 50
26. Birds 51
    The Food of Birds 52
    Nesting Boxes 59
    The Crow 62
    How to Teach Birds to Primary Children 64
    The Robin 64
    Birds That Tell Their Names 64
    Study of the Hen 65
27. Fishes 66
28. Amphibians 68
    (a) The Spotted Newt 70
    (b) The Large Spotted Salamander 71
    (c) Red-Backed Salamander 71
    (d) The Dusky Salamander 71
    (e) The Slimy Salamander 71
29. Reptiles 71
30. Mammals 73
    (a) The Horse 73
    (b) The Cow 78

PAGE

(c) Sheep ... 80
(d) The Dog ... 81
(e) The Cat ... 82
(f) Rats and Mice ... 83
(g) Squirrels ... 84
(h) Rabbits ... 86
31. Insects ... 86
The Eggs ... 88
The Larva ... 88
The Pupa ... 88
The Adult ... 89
Reference Books ... 90
Test Questions ... 91

Practical Studies

Lessons on the Grape ... 92
Lessons on the Fly ... 106
Lessons on the Mosquito ... 121

bird studies

The Indigo Bunting ... 128
Baltimore Oriole ... 128
Cowbird ... 129
Goldfinch ... 130
Scarlet Tanager ... 131
Woodpecker ... 131
Sandpiper ... 132

PLANS FOR TEACHING NATURE STUDY

First Year

SEPTEMBER

1. First Week ... 133
2. Second Week ... 133
3. Third Week ... 133
4. Fourth Week ... 134

OCTOBER

5. First Week ... 134
6. Second Week ... 134
7. Third Week ... 134
8. Fourth Week ... 135

NOVEMBER PAGE

9. First Week 135
10. Second Week 135
11. Third Week 135
12. Fourth Week 136

DECEMBER

13. First Week 136
14. Second Week 136
15. Third Week 136

JANUARY

16. First Week 137
17. Second Week 137
18. Third Week 137
19. Fourth Week 137

FEBRUARY

20. First Week 137
21. Second Week 137
22. Third Week 137
23. Fourth Week 138

MARCH

24. First Week 138
25. Second Week 138
26. Third Week 138
27. Fourth Week 138

APRIL

28. First Week 139
29. Second Week 139
30. Third Week 139
31. Fourth Week 139

MAY

32. First Week 140
33. Second Week 140
34. Third Week 140
35. Fourth Week 140

JUNE

36. First Week 141
37. Second Week 141

Second Year

SEPTEMBER — PAGE

1. First Week 141
2. Second Week 141
3. Third Week 141
4. Fourth Week 141

OCTOBER

5. First Week 141
6. Second Week 142
7. Third Week 142
8. Fourth Week 142

NOVEMBER

9. First Week 142
10. Second Week 142
11. Third Week 142
12. Fourth Week 142

DECEMBER

13. First Week 143
14. Second Week 143
15. Third Week 143

JANUARY

16. First Week 143
17. Second Week 143
18. Third Week 144
19. Fourth Week 144

FEBRUARY

20. First Week 144
21. Second Week 144
22. Third Week 144
23. Fourth Week 145

MARCH

24. First Week 145
25. Second Week 145
26. Third Week 145
27. Fourth Week 146

APRIL

28. First Week 146
29. Second Week 146

PAGE
30. Third Week 146
31. Fourth Week 147

MAY

32. First Week 147
33. Second Week 147
34. Third Week 147
35. Fourth Week 147

JUNE

36. First Week 147
37. Second Week 147

Third Year

SEPTEMBER

1. First Week 147
2. Second Week 148
3. Third Week 148
4. Fourth Week 148

OCTOBER

5. First Week 148
6. Second Week 148
7. Third Week 148
8. Fourth Week 148

NOVEMBER

9. First Week 148
10. Second Week 149
11. Third Week 149
12. Fourth Week 149

DECEMBER

13. First Week 149
14. Second Week 149
15. Third Week 149

JANUARY

16. First Week 149
17. Second Week 149
18. Third Week 149
19. Fourth Week 149

FEBRUARY PAGE

20. First Week 150
21. Second Week 150
22. Third Week 150
23. Fourth Week 150

MARCH

24. First Week 150
25. Second Week 150
26. Third Week 150
27. Fourth Week 150

APRIL

28. First Week 150
29. Second Week 151
30. Third Week 151
31. Fourth Week 151

MAY

32. First Week 151
33. Second Week 151
34. Third Week 152
35. Fourth Week 152

JUNE

36. First Week 152
37. Second Week 152

CHAPTER TWO

Phonics

Introduction 153, 154
1. Essentials 154
2. Difficulties 155
   (a) Learning the Sounds 155
   (b) Blending 155
3. Devices 155
   (a) Stories and Pictures 155
   (b) Diacritic Marks 155
   (c) Consonants 156
   (d) Word Families 156
   (e) Use of Phonograms 156
   (f) Special Letters 157

SUGGESTIVE PLAN PAGE

4. The Eclectic Method ... 157
5. First Steps ... 158
6. Use of Reading Lesson ... 158
   (a) The Goal ... 159
   (b) Plans ... 159
7. Games ... 160
   (a) Sharp Ears ... 160
   (b) Name-Sounds ... 160
   (c) Drill Cards ... 160
   (d) Racing ... 160
   (e) Sight-word Games ... 160
   (f) Choosing the Pictures ... 162

PHONICS FOR FIRST TWO GRADES

8. A Separate Study ... 163
9. Training Ear and Tongue ... 163
   (a) Training the Ear ... 163
   (b) Training the Tongue ... 164
10. Associating Sound and Symbol ... 164
   (a) Resemblances ... 165
   (b) Initial Vowels ... 165
   (c) First Use of Phonics in Reading ... 166
11. Diacritic Marks ... 166
12. Syllabication ... 169
13. Summary ... 169
14. Suggestive Lesson One ... 170
15. Suggestive Lesson Two ... 170
16. Suggestive Lesson Three ... 171
17. Hand-made Phonetic Drill Cards ... 172
18. Directions for Making ... 174
Test Questions ... 176

CHAPTER THREE

Number

INTRODUCTION

1. Purpose ... 177
2. Criticisms ... 178
   (a) Basis for Criticism ... 179
   (b) Factors in the Problem ... 179
3. Changes Demanded ... 181
   (a) The Committee of Fifteen ... 182

PAGE

(b) Business Men ... 183
(c) High-School Teachers ... 183
4. Time Expended ... 183
(a) Unreasonable Problems ... 184
(b) Mental Discipline ... 184
5. Arithmetic not Difficult ... 185
6. Wrong Methods ... 186
(a) The Starting Point ... 186
(b) Too Early Use of Explanations and Analysis ... 187
(c) Methods in Other Branches ... 187
(d) Enthusiasm Crushed ... 188
(e) Arithmetical Processes Needed ... 188
7. Why Teach Arithmetic ... 188
8. How Much Arithmetic ... 190
(a) Fundamental Operations ... 191
(b) Work of the Primary School ... 192
(c) Children Leave School Early ... 192
(d) Pupils Must be Interested ... 193
9. The Matter of Methods ... 193
(a) Fundamental Considerations ... 194
10. Elements of Waste in the Teaching of Arithmetic ... 195
(a) Scientific Study Necessary ... 195
(b) Impractical Ideas ... 196
11. The Problem-Material ... 196
(a) Dramatization ... 197
(b) Number Games ... 198
12. Sources of Problem-Material ... 199
(a) Text-Books Not Adequate ... 199
(b) Problems of Life-Interest ... 199
(c) Value of Practical Problems ... 200
(d) Solution of Problems Necessary ... 201
(e) Knowledge Necessary to the Teacher ... 201
13. Adaptation of Problem-Material ... 203
(a) The Pupil's Mental Status ... 203
(b) The Pupil's Taste ... 204
(c) The Pupil's Comprehension ... 205
(d) Conclusion ... 205

FIRST YEAR NUMBER WORK

14. Introduction ... 206
15. Incidental Teaching ... 207
16. The Number Consciousness ... 207
17. Why Teach Number in the First Grade ... 208
(a) Compared with Other Branches ... 208
(b) Important Tests ... 210

PAGE

18. The Allotment 211
19. Psychological Principles 212
    (a) Origin of the Number Concept 212
    (b) Number an Abstract Idea 213
    (c) The Desire for Grouping 213
    (d) Uses of Numbers Artificial 215
20. Concrete Problems 216
21. Nature of Mental Acquisition 217
    (a) Acquiring a Vocabulary 218
    (b) Acquiring the Number Concept 218
    (c) Application of Principles 219
22. Range for the First Year 219
23. Distinction Between Devices and Methods 220
24. Underlying Principles and Courses of Study 221
    (a) Precedent 222
    (b) New York Course of Study 222
    (c) Points Emphasized 223
    (d) Dangers to be Avoided 223
25. Objects Before Symbols 224
26. Counting 225
    (a) Exercises 225
    (b) Drills 229
    (c) Games 232
    (d) Number Pictures 232
27. Number Cards 233
    (a) Visualization 234
    (b) Cumbersome Methods 238
    (c) Multiplication Tables 238
    (d) Extent of Use 239
28. Duplications 240
29. Division 241
30. Solution of Problems 241
31. Fractions 242
32. Reading and Writing Numbers 242
    (a) Calculations to Twelve 243
    (b) Addition and Subtraction 243
    (c) Multiplication 244
33. Fractions 244
34. Explanations 245
35. The Use of Measuring Units 247
    (a) The School Store 248
36. Use of Games in Teaching Number 249
    (a) Bean Bag 249
    (b) Tag 250

PAGE

(c) Odd and Even 250
(d) Around the Circle 250
37. The Combinations 251
(a) Roman Numerals 252
38. The Principle of Correlation 252
(a) Drawing 254
(b) The Ruler 254
39. Lessons to Cultivate Ability to Judge Measurements 255
(a) Material 255
(b) Method 255
40. Books for Teachers 257

Second Year

41. Review First Grade Directions 258
42. Text-Book 258
43. Illustrated Lesson 259
44. Reviews and Drills 261
45. The Forty-Five Combinations 262
46. Reading and Writing Numbers 262
47. Carrying in Addition 263
48. Borrowing in Subtraction 264
49. Counting 265
50. Factoring 266
51. Fractions 268
52. Order of Presentation 269
53. Arithmetic as Ratio 269
54. Vocational Problems 271
55. Variety of Problems 272
56. Measuring 272
(a) Dry and Liquid Measures 273
57. Devices for Drilling in Multiplication 274
58. Division 276

Third Year

59. Reviews 277
(a) Preparation for Text-Book 277
(b) Thoroughness 278
(c) Time Required 278
60. Work in Multiplication 278
61. Making Change 282
62. Multiplication by Two or More Figures 283
63. Division 284
(a) Short Division 284
(b) Long Division 284

PAGE
64. Written Work 285
65. United States Money 285
66. Conclusion 285
Test Questions 286

PLANS FOR TEACHING PRIMARY NUMBER WORK

First Year

SEPTEMBER

1. First Week 287
2. Second Week 288
3. Third Week 288
4. Fourth Week 289

OCTOBER

5. First Week 289
6. Second Week 290
7. Third Week 290
8. Fourth Week 291

NOVEMBER

9. First Week 291
10. Second Week 292
11. Third Week 292
12. Fourth Week 293

DECEMBER

13. First Week 293
14. Second Week 294
15. Third Week 294

JANUARY

16. First Week 295
17. Second Week 295
18. Third Week 295
19. Fourth Week 296

FEBRUARY

20. First Week 296
21. Second Week 296
22. Third Week 296
23. Fourth Week 297

MARCH PAGE

24. First Week 297
25. Second Week 298
26. Third Week 298
27. Fourth Week 298

APRIL

28. First Week 298
29. Second Week 298
30. Third Week 299
31. Fourth Week 299

MAY

32. First Week 299
33. Second Week 299
34. Third Week 300
35. Fourth Week 300

JUNE

36. First and Second Weeks 300

Second Year

SEPTEMBER

1. First Week 301
2. Second Week 301
3. Third Week 301
4. Fourth Week 301

OCTOBER

5. First Week 302
6. Second Week 302
7. Third Week 302
8. Fourth Week 302

NOVEMBER

9. First Week 303
10. Second Week 303
11. Third Week 303
12. Fourth Week 304

DECEMBER

13. First Week 305
14. Second Week 305
15. Third Week 305

JANUARY PAGE

16. First Week 305
17. Second Week 306
18. Third Week 306
19. Fourth Week 306

FEBRUARY

20. First Week 306
21. Second Week 307
22. Third Week 307
23. Fourth Week 307

MARCH

24. First Week 307
25. Second Week 307
26. Third Week 308
27. Fourth Week 308

APRIL

28. First Week 308
29. Second Week 308
30. Third Week 309
31. Fourth Week 309

MAY

32. First Week 309
33. Second Week 309
34. Third Week 309
35. Fourth Week 309

JUNE

36. First and Second Weeks 310

Third Year

SEPTEMBER

1. First Week 310
2. Second Week 310
3. Third Week 310
4. Fourth Week 310

OCTOBER

5. First Week 311
6. Second Week 311

PAGE

7. Third Week 311
8. Fourth Week 311

NOVEMBER

9. First Week 311
10. Second Week 312
11. Third Week 312
12. Fourth Week 312

DECEMBER

13. First Week 312
14. Second Week 312
15. Third Week 313

JANUARY

16. First Week 313
17. Second Week 313
18. Third Week 313
19. Fourth Week 314

FEBRUARY

20. First Week 314
21. Second Week 314
22. Third Week 315
23. Fourth Week 315

MARCH

24. First Week 315
25. Second Week 315
26. Third Week 316
27. Fourth Week 316

APRIL

28. First Week 316
29. Second Week 316
30. Third Week 316
31. Fourth Week 316

MAY

32. First Week 316
33. Second Week 317
34. Third Week 317
35. Fourth Week 317

JUNE

Review Exercises 317–318

CHAPTER FOUR

Drawing

INTRODUCTION

1. Aim of the Lessons 319
2. Arrangement of Plan 320
3. Materials 321
   (a) Paper 321
   (b) Pencils 321
   (c) Crayons 322
   (d) Water Colors 322
   (e) Brushes 322
   (f) Water Color Pan 322
   (g) General Care of Materials 322
4. Supplies and Supply Houses 323

SEPTEMBER

5. First Week 324
   (a) Decorating the Schoolroom 324
   (b) Lessons in Color 324
   (c) Use of Water Colors 325
6. Second Week 326
   (a) Free Illustration 326
   (b) Figure Drawing 328
7. Third Week 330
   (a) Study of Grasses 330
   (b) Memory Drawings 330
8. Fourth Week 330
   (a) Flower Painting 330
   (b) Memory Lessons 332
   (c) Exhibits 333

OCTOBER

9. Nature Walks 334
10. First Week 334
   (a) Autumn Weeds 334
   (b) Seat Work 336
11. Second Week 336
   (a) Autumn Leaves 336
   (b) Book Cover 338
12. Third Week 338
   (a) Trees 338
   (b) Landscapes 339
   (c) Illustrating a Poem 339

PAGE

13. Fourth Week 339
    (a) Fruits 339
    (b) Modeling 340

NOVEMBER

14. Preparatory Work 342
15. First Week 342
    (a) Fruits and Vegetables 342
    (b) Cutting and Modeling 344
16. Second Week 344
    (a) Outdoor Studies 344
    (b) Illustrate Reading Lessons 344
17. Third Week 346
    Special Events 346
18. Fourth Week 346
    Preparation for Thanksgiving 346

DECEMBER

19. Nature and Picture Study 350
20. First Week 350
    Winter Sports 350
21. Second Week 352
    Winter Landscape 352
22. Third Week 354
    Preparations for Christmas 354

JANUARY

23. First Week 356
    Toys 356
24. Second Week 358
    (a) Object Drawing 358
    (b) The Pencil 358
25. Third Week 358
    Object Drawing (Continued) 358
26. Fourth Week 360
    Object Drawing (Continued) 360

FEBRUARY

27. Preparation for Special Days 362
28. First Week 364
    Receding Lines 364
29. Second Week 366
    (a) Perspective 366

PAGE

(b) Lincoln's Birthplace 367
(c) Valentines 367
30. Third Week 367
(a) The National Flag 367
(b) Soldier's Hat 368
(c) Soldier's Figure 368
31. Fourth Week 368
Illustrated Stories 368

MARCH

32. The Month of Awakening 369
33. First Week 369
(a) Illustrated Poems 369
(b) Paper Cutting 370
34. Second Week 370
Buds and Branches 370
35. Third Week 372
Studies in Figures 372
36. Fourth Week 372
(a) Outdoor Studies 372
(b) Picture Study 374

APRIL

37. Springtime 374
38. First Week 376
(a) A Study in Birds 376
(b) Bird Booklet 376
39. Second Week 376
Garden Scenes 376
40. Third Week 378
Spring Landscape 378
41. Fourth Week 378
(a) Spring Flowers 378
(b) May Baskets 380

MAY

42. Animal Life 380
43. First Week 382
(a) Study of Animals 382
(b) Designs 382
44. Second Week 384
Stained Glass Effects 384
45. Third and Fourth Weeks 384
Articles for the Home 384

JUNE

PAGE
46. The Annual Exhibition ... 388
47. First Week ... 388
Invitations ... 388
48. Second Week ... 390
(a) Outdoor Studies ... 390
(b) Animal Studies ... 390
(c) Flags ... 390
49. Third Week ... 390
Art Portfolio ... 390

FIGURE DRAWING

50. A Source of Pleasure ... 393
51. Trees ... 393
52. Design ... 393
53. Lettering ... 393
54. Toys ... 393
55. Figure and Animal Drawings ... 394

BLACKBOARD DRAWING

56. Value to the Teacher ... 394
57. Method of Procedure ... 402
58. The Blackboard Calendar ... 402
(a) How to Secure the Correct Proportions ... 406
(b) Subject Matter ... 406

Picture Study

INTRODUCTION

59. Value ... 414
60. Classification of Pictures ... 414
61. Method ... 414
(a) Study of the Picture ... 414
(b) Hanging ... 415
(c) Framing ... 416
(d) Study of Surroundings ... 416

STUDIES

62. Shoeing the Bay Mare ... 416
(a) The Picture ... 416
(b) The Artist ... 417
63. Feeding Her Birds ... 418
(a) The Picture ... 418
(b) The Artist ... 418

PAGE

64. Madonna of the Chair 419
(a) The Picture 419
(b) The Artist 420
65. Children of Charles I 421
(a) The Picture 421
(b) The Artist 422
66. A Helping Hand 422
(a) The Picture 422
(b) The Artist 423
(c) Boat Pictures 423
67. Penn's Treaty with the Indians 424
(a) The Picture 424
(b) The Artist 424

CHAPTER FIVE

Spelling

1. What Spelling Includes 426
2. Preparatory Work 427
3. Oral and Written Spelling 427
4. The First Lessons 428
5. How Much to Spell 429
6. Plan for Written Spelling 429
7. Deficient Children 431
8. How to Study Spelling Lessons 432
9. Visualization 434
10. Value of the Imaging Power 435
11. The Law of Association 435
12. Spelling and Drawing 436
13. Spelling in Sentences 436
14. Rules for Teachers 437
Test Questions 438

CHAPTER SIX

Penmanship

First, Second and Third Grades

Introduction

1. A Means of Expression 439
2. The Teacher's Problem 439
3. The Pupils 440
4. The Montessori Plan 440

FIRST GRADE

METHOD OF PROCEDURE 441
5. POSITION 442
(a) The Body 442
(b) The Arms 443
(c) The Hands 443
(d) The Pencil 443
(e) The Paper 444
(f) Importance 444
6. THE BLACKBOARD 444
(a) Teacher's Preparation 445
(b) The First Lesson 445
(c) Other Lessons 447
7. SEAT WORK 447
(a) General Directions 448
(b) Suggestions 448
8. ADDITIONAL PRINCIPLES 448
9. COMBINING PRINCIPLES 449
(a) Suggestions 450
10. REVIEWS 450
11. MORE LETTERS AND WORDS 451
12. LOOP LETTERS 453
13. WRITING IN SMALLER SPACE 454
14. CAPITAL LETTERS 455
15. WRITTEN EXERCISES 455

SECOND GRADE

16. Purpose 455
17. DRILLS 456
18. REVIEWS 456
19. NEW EXERCISES 457
20. LETTER ANALYSIS 458
21. FIGURES 462
22. USE OF PEN AND INK 462
(a) Materials 463
(b) Movements 463
(c) Directions 464
23. WRITTEN EXERCISES 464

THIRD GRADE

24. THIRD GRADE ESSENTIALS 465
25. CONDITIONS 466
26. SUGGESTIONS 466

PAGE
27. Reviews ... 467
28. New Exercises ... 467
29. Written Work ... 467
30. Criticism ... 468

CHAPTER SEVEN

Use of the Senses

1. Function of the Senses ... 469
2. Relation of the Senses and Knowledge ... 469
3. Necessity for Use of the Senses ... 470
4. Defective Sense Organs ... 471
(a) Development of the Sense Organs ... 471
(b) The Functions of Each Sense ... 472
(c) All the Senses Must be Used ... 472
(d) Proper Physical Conditions ... 472
5. From Objects to Books ... 473
(a) The Montessori Plan ... 473
(b) Material ... 474
(c) Value of Indirect Training ... 474
6. Direct Sense Training ... 474
(a) Sight and Hearing ... 474
(b) Taste and Smell ... 475
(c) Touch ... 476
7. Guiding Principles ... 477
8. Books for Teachers ... 477
Test Questions ... 478

ILLUSTRATIONS

PAGE

JOHANN HEINRICH PESTALOZZI. *Halftone* ..... *Frontispiece*
CHILDREN AROUND THE NATURE STUDY TABLE. *Halftone* 4
THE WALL TABLE 8
A MODEL TERRARIUM 10
MANY INTERESTING ANIMALS VISIT THE SCHOOL 11
STUDYING LIFE IN THE AQUARIUM 14
TRIPOD LENS 15
CRICKET CAGE 15
A COVERED BASKET IS VERY USEFUL 15
TEAKETTLE AND SPIRIT LAMP 16
A TRIP AFIELD. *Halftone* 18
FORMING RAINDROPS 21
A LANDSCAPE STUDY 26
TROPICAL LANDSCAPE — POLAR LANDSCAPE 27
A CHRISTMAS TREE FOR BIRDS AND ANIMALS 41
THE CROW 63
THE ROBIN. *Color Plate* 64
A TADPOLE AQUARIUM 68
DEVELOPMENT OF THE TOAD 69
INDOOR QUARTERS FOR SALAMANDERS 71
THE HORSE 74
THE COW 78
THE SHEEP 81
ANIMALS FOR NATURE STUDY 85
A PUPA 88
LIVING DECORATION OF A DINING PORCH. *Halftone* 92
TWO METHODS OF MAKING A GRAPE LAYER 95
LAYER OF WORDEN GRAPE, AUTUMN AFTER LAYING 96
GRAPE LAYER 97
SETTING A GRAPE CUTTING 98
GRAPE CUTTING 99
GRAPE BLOSSOMS 100
ONE YEAR'S WORK OF A GRAPE BUD 104
A DAY'S CATCH — A SEASON'S CATCH. *Halftone* 110
STABLE WINDOW FLY-TRAP IN POSITION 113
EXPLANATORY MODEL OF STABLE WINDOW FLY-TRAP 115
FIRST MODEL OF EXTERMINATOR FOR EXPERIMENTAL PURPOSES 119
OUTDOOR FLY EXTERMINATOR 120
CULEX PIPIENS MALE AND FEMALE 122
PUPAE OF MOSQUITOES 123
BOTTLE FOR CATCHING MOSQUITOES 124

PAGE

Jam Bottle and Tumbler Arranged to Obtain Mosquito Eggs.. 125
Exterminating Mosquitoes. *Halftone*.... 126
Our Friends the Birds. *Color Plate*.... 128
Devices for Teaching Phonics.... 161
Recognition of Sounds. *Halftone*.... 164
Number Chart Showing Facts Connected with the Number 7 214
Devices for Teaching Children to Count by 2's, 3's, 4's and 5's.... 230, 231
Diagrams Showing Primary Combinations.... 235–237
Equal Parts. Fig. 2 and Fig. 3.... 246
Fractional Parts. Fig. 4.... 246
Divided Halves. Fig. 5.... 247
Parts of Thirds. Fig. 6.... 247
Divided Fourths. Fig. 7.... 247
Number Chart.... 253
Six-Inch Rule.... 254
Liquid Measures.... 255
Dry Measures.... 256
Number Lesson. *Halftone*.... 256
Counting by 6's, 7's and 8's.... 265
Counting by 9's and 10's.... 266
One — Halves — Thirds — Fourths.... 267
The Unit — Halves.... 268
Purchasing Eggs.... 271
The Store Scale.... 272
Using the Scale.... 272
Eggs Are Sold by the Dozen.... 273
Two Pints Make One Quart.... 273
Measures Used in Selling Milk.... 274
A Good Device for Drill Exercises.... 275
Dividing Into Equal Parts.... 276
Figures Expressed by Straight Lines.... 327
Figure Painting in Water Color or Ink Work.... 329
Grass Studies in Pencil, Crayon or Brush Work.... 331
Studies of Seed Pods, in Water Color or Ink.... 335
The Maple — Maple Leaves. *Color Plate*.... 336
Tree Studies in Water Color or Ink.... 337
An October Landscape. *Color Plate*.... 338
The Pumpkin. *Color Plate*.... 338
Clay Modeling. *Halftone*.... 340
Study of Fruit Branch in Black Water Color or Ink.... 343
Design for the Story of Little Agoonack.... 345
The Home of Hiawatha.... 347
The Story of The Three Bears.... 349

PAGE

Conventionalized Units, to Decorate Objects Made by Pupils.. 351
Pattern of Portfolio, with Suggested Units for a Design..... 353
Pattern and Designs for Square Box..... 355
Christmas Toys Bring Children's Joys..... 357
Toy Drum. *Color Plate*..... 358
Appearance of Drum in Different Positions..... 359
Japanese Lantern. *Color Plate*..... 360
Appearance of Basket in Different Positions..... 361
Crayon Work. *Halftone*..... 362
Studies of Familiar Objects in Silhouette Effects..... 363
Receding Lines and Objects in Perspective..... 365
Illustrating the Week's Work, by Children Posing..... 371
The Morning Walk. *Color Plate*..... 372
Figure Painting in Silhouette — Children's Work..... 373
Illustrating Children's Games — Children's Work..... 375
Spring Buds and Flowers; Designs for Spring Booklets..... 377
"Ulysses Plowing"— Freehand Cutting by Pupil in First Grade 379
Tulips. *Color Plate*..... 380
Animal Studies in Crayon..... 381
Conventionalized Designs..... 383
In the Farm Yard. *Color Plate*..... 384
Spring Flowers, in Water Color or Ink Work..... 385
Animals in Freehand Paper Tearing — Children's Work..... 387
Circus Day Memories — Children's Work..... 389
Story-Telling with Figures in Lines..... 392
Figures Showing Line Structure and Mass..... 395
Tree Studies Showing Structure..... 396
Animal Studies in Crayon or Water Colors..... 397
Animal Toys in Crayon or Water Colors..... 398
Designs for Stick Printing or Tablet and Stick Laying....399, 400
Crayon or Brush Work..... 401
Designs for Booklet Covers..... 403
Designs for Calendars:
September..... 403
October..... 404
November..... 405
December..... 407
January..... 408
February..... 409
March..... 410
April..... 411
May..... 412
June..... 413
Madonna of The Chair. *Halftone*..... 414

PAGE

Shoeing The Bay Mare. *Halftone* 416
Feeding Her Birds. *Halftone* 418
Children of Charles I. *Halftone* 420
The Helping Hand. *Halftone* 422
Penn's Treaty with the Indians. *Color Plate* 424
Perception Letter. Fig. 1 441
Correct Position. Fig. 2 442
Position of the Hand. Fig. 3 443
The Pencil. Fig. 4 443
The Paper. Fig. 5 444
Position of Chalk in Hand. Fig. 6 446
Writing in Smaller Space. Fig. 7 and Fig. 8 ..... 454, 456
Figures. Fig. 9 462
Position of Pen, Hand and Fore-Arm. Fig. 10 463

CHAPTER ONE

ALICE G. MCCLOSKEY

Late Associate Director Rural School Education Extension, New York State College of Agriculture, Editor Cornell Rural School Leaflets, Cornell University, Ithaca, New York

I am forced to conclude that my passion for nature and for all open-air life though tinged and stimulated by science, is not a passion for pure science, but for literature and philosophy. My imagination and ingrained humanism are appealed to by the facts and methods of natural history. I find something akin to poetry and religion (using the latter word in its non-mythological sense, as indicating the sum of mystery and reverence we feel in the presence of the great facts of life and death) in the shows of day and night, and in my excursions to fields and woods. The love of nature is a different thing from the love of science, though the two may go together.—John Burroughs.

O ye whose living is not *Life*,
Whose dying is but death,
Song, empty toil and petty strife,
Rounded with loss of breath!
Go, look on Nature's countenance,
Drink in the blessing of her glance;
Look on the sunset, hear the wind,
The cataract, the awful thunder;
Go, worship by the sea;
Then, and then only, shall ye find,
With ever-growing wonder,
Man is not all in all to ye;
Go with a meek and humble soul,

Then shall the scales of self unroll
From off your eyes — the weary packs
Drop from your heavy-laden backs;
And ye shall see,
With reverent and hopeful eyes,
Glowing with new-born energies,
How great a thing it is to *Be*!— Lowell.

FOREWORD

1. Educational Value. The importance of nature study has been well presented so many times that it is not necessary to give in these pages the specific advantages to be gained from it. Like many other new subjects in education, it has been much abused, and from farmers, parents and superintendents of schools there has been just criticism of the weaknesses manifest in teaching it. Effort must be made by all educators to establish sane, wholesome, virile instruction that shall accomplish the purposes for which nature study has been made a part of every well-organized school curriculum. Following are some facts that should be kept in mind if the work is to be worth while:

(1) Nature study is a study of nature. Simple as this appears, in many instances it has not seemed to be understood. Nature study has its greatest value when natural objects and phenomena are studied out-of-doors. It must not be lost in outlines, nor books, nor charts, nor pictures, nor stuffed birds, nor dead insects. It is the study of things as they are, and, whenever possible, in places in which they belong. If class work can not be given out-of-doors, let material be collected by the pupils. Encourage observational work in the open. Nature must provide the material for lessons that are worth while. It can not be made in print shop or factory. Educational results are gained by observation, patient inquiry, experiment, research.

(2) Nature study is based on truth, not imagination, not sentimentality. It has interest of its own and need not be introduced by fairy or goblin.

3. Nature study deepens the child's touch with natural objects and forces and develops mind and soul and body by means of things that he has known from the beginning. His baby eyes blinked at the sunbeam; his tiny finger pointed to the moon; his hand reached out for a flower; he helped to make a garden; and did he not follow the winds and call to the birds and play with the sands of the sea?

4. Nature study lays the foundation for the greatest of all industries, agriculture; an industry that is absolutely essential to national prosperity; an industry in which every child, as producer or consumer, is an economic factor.

5. One nature lesson well taught will go farther than a great number of lessons treated superficially and inaccurately.

6. Nature study material can be used for language lessons, drawing, geography—in fact, for nearly all school work. In correlating nature study lessons with other subjects in the lower grades, care must be taken to avoid too much of any one subject. A little child even when he reaches the third grade needs variety and should have opportunity to let his mind go back into some natural channel that belongs to his individual way of thinking. In this connection it would be well for the teacher to read the following poem, and to read it again and still again. It is good pedagogy for the nature teacher:

THE CHILD'S REALM

BY L. H. BAILEY

A little child sat on the sloping strand
Gazing at the flow and the free,
Thrusting its feet in the golden sand,
Playing with the waves and the sea.

I snatch'd a weed that toss'd on the flood
And parted its tangled skeins;
I trac'd the course of the fertile blood
That lay in its meshed veins;

I told how the stars are garner'd in space,
How the moon on its course is roll'd,
How the earth is hung in its ceaseless place
As it whirls in its orbit old:—

The little child paus'd with its busy hands
And gaz'd for a moment at me,
Then dropp'd again to its golden sands
And play'd with the waves and the sea.

7. In every school subject the practical side of the child's development must be a consideration. He must not, because of any scholastic aristocracy on the part of the teacher, be unable to make his contribution to human needs and to know the joy of work well done. There is splendid dignity in preparing a practical man or woman for a life work. This secured without neglect of the thought and study that quicken the spirit, gives an all-round fitness for life to which every child has a right. Nature study offers a rich, practical field for educational purposes. It should be used whenever possible.

8. The teacher in the first three grades should remember that she is leading the child into nature sympathy and understanding and that she is *not teaching science.* If the work is based on truth, there need be no fear of the criticism of the scientist. Through nature, sympathy and observation the little children will have foundation for science and for scientific agriculture, by developing a live interest in growing things, and in studying the relation that these natural objects bear to forces and phenomena in nature. Simplicity of instruction will be the safest course to pursue.

It will be better to err in the direction of teaching too little in nature study rather than too much. Consider carefully the voice that can speak with authority on this subject, in that of John Burroughs, who says:

> I am not always in sympathy with nature study as it is taught in the schools. Such study is too cold, too special, too mechanical; it is likely to rub the bloom off nature; it misses the accessories of the open air and its exhilarations, the sky, the clouds, the landscape, and the currents of life that pulse everywhere.

CHILDREN AROUND THE NATURE STUDY TABLE

9. Teach the things that have relation to the daily lives of the children. In every instance possible the boys and girls should form habits of making observations in the open. In rural districts and in villages this can be done, and all material can be secured by the pupils. In congested city districts the close and familiar observations must be made indoors. With trolley systems, however, and with the aid of boys in the grammar schools and high schools, much good material can be brought into the school from week to week. Do not fail to ask the older boys and girls to help in collecting nature study material. It will be good for them, and the result will be that many interesting specimens will be furnished for the lower grades.

Some thinking people doubt the value of trying to teach children subject-matter in nature in the congested city districts, but a study of life is always worth while, and even canaries, gold fishes, and kittens are better than nothing at all for the little children to know, to love, and to care for. Good observation as well as the humane treatment of animals can be taught through such experience. In addition to the study of animal life there is abundance of opportunity for plant study in the city, and fortunately buildings can not shut out some of the great natural forces and phenomena.

2. Qualifications of a Good Teacher. What qualifications should the teacher have? At least he requires the nature sympathy that every human soul needs to keep him near to his highest self: response to the sun and wind and rain; to starry night and moonlit wood; to brook and lake and ocean; to wayside flowers; to moss and fern; to the smell of plowed fields; to the mystery of a seed; to the glory of orchard in bloom or in harvest; to level sunlit corn lands; to far-reaching timothy fields; to the song of early birds; to the dawn of a new day. All these things come with the love of nature; but the nature study teacher should have more than love of nature. Accurate nature knowledge, however simple it may be, is essential. Many teachers

have obtained this preparation themselves, with the aid of their pupils and a small working library. This is a good way to obtain it. Each quest opens many new lines of thought; interest deepens as the list of discoveries lengthens.

Perhaps equally important with love of nature and nature knowledge is the need for the nature teacher to root out the notion held by some persons that education in nature can not come through practical things. The grains, the grasses, the clovers, the vetches, the fruit trees, the grape vines, the garden crops, the farm animals and all the rest, have a rich educational value that can not be questioned. The pastoral outlook is full of beauty, of truth, of resource, of economic import. Why lose all this? A qualification of the nature study teacher is to know that natural objects of economic importance are to some children the most interesting of all. When this interest manifests itself in the first three grades it should be encouraged.

3. Equipment for the Teacher. The teacher will not need costly equipment for nature study lessons in the lower grades. The mental equipment is the most essential—the realization of the importance of the study; the necessity of collecting information first hand to teach it. The following will be valuable:

1. A copy of *The Nature Study Idea*, by Liberty H. Bailey. MacMillan Co. A thorough reading of this book will prevent any teacher from becoming warped by an artificial attitude to nature study teaching.

2. *Nature Study and Life*, by Hodge. Ginn & Co. This book is practical, wholesome, and full of spirit. It gives material for specific instruction, all of which is worth the while and all of which has relation to the child's life.

3. A copy of Stevenson's *A Child's Garden of Verses*. Charles Scribner's Sons. For the primary teacher this book is indispensable. It touches child life in a literary way. Memory selections taken from this work are far more desirable than the many poems published for little children that do not have a fundamental literary value. Through these

poems some of the influences may be given to the child that helped to develop the sensitive, deep, responsive spirit of Robert Louis Stevenson. Among the most charming of the poems are *My Shadow, The Cow, The Wind, The Sun's Travels, The Lamplighter, The Moon, The Hayloft, Farewell to the Farm, Nest Eggs, The Flowers, Summer Sun.*

4. One pair of good opera glasses or field glasses. Bird study is important and interesting in the lower grades. As soon as possible a teacher should become familiar with the common birds, with their habit of flight, with their notes. An opera glass helps in the study.

5. Field clothing: one rubber coat; one pair of waterproof shoes; one rainproof hat. No teacher can give good instruction in nature who has not learned to find the out-of-doors in all kinds of weather.

6. A botany can.

7. A trowel.

8. A pair of shears.

9. A jackknife.

10. A library that grows slowly, but with interest in each book. Decide the first year to make a serious study of one subject—trees, flowers, birds, garden plants, farm crops, farm animals, insects, or any other. Let the book be used when the out-of-door study has awakened inquiry.

11. A notebook. The teacher should have a notebook in which is kept a record of all outdoor observations and important facts relating to such observations found in reference books. The notebook should be indexed. Every teacher should keep such records. They will be valuable if she remains in school work, and equally valuable in any walk in life.

4. Equipment for the Schoolroom. 1. A wall table that can be raised and lowered.

2. A terrarium (pages 10 and 11).

3. An aquarium (page 14).

4. A cricket cage (page 15).

5. Tripod lens (page 15).

6. Basket (page 15).
7. Flower pots.
8. A teakettle and spirit lamp (page 16).
9. A few strong pasteboard boxes, labeled.
10. A few yards of cheesecloth.
11. Two or three sets of small garden tools.
12. A simple table service for two persons—toy or full-size dishes.

5. How to Use the Schoolroom Equipment. 1. The Wall Table. A corner or one side of the schoolroom might well be reserved for nature study objects of interest. Children are constantly bringing things into the schoolroom, and these should be so placed and cared for that they will give the least trouble to the teacher. A stationary wall table made of smooth boards on brackets will be satisfactory.

THE WALL TABLE

A village or city carpenter or some one in the rural district who is handy with tools will be glad to help the teacher to secure this convenient and essential piece of furnishing. A table on hinges that can be let down on occasion is even more convenient for small schoolrooms. The children should be taught to keep the wall table in order. On it can be

kept a few French glass bottles with flat sides as shown in the illustration. These are useful for the study of live insects and can be passed around the class for observational work. The restless boy can be sent out with one to find some insect for study—bee, beetle, caterpillar. The bottles can be purchased of any druggist for 50 cents a dozen. They are better than round bottles, because the flat sides will not distort the appearance of the insects and other forms of life that are placed in them. The aquarium jar and cricket cage can be kept on the table. Here also can be kept the birds' nests that the children find; also, the nests of hornets and the homes of other wild things. There should be a scrap book on this table made by the children in which are placed nature pictures of objects already studied. One of the most valuable factors in the use of the table will be to have the boys and girls keep it in order, thereby teaching a lesson in housekeeping. This will often give occupation for restless spirits.

2. A TERRARIUM. Every school should have a terrarium. A more simple one than illustrated on pages 10 and 11 will answer the purpose, but even if the children construct one they should be helped to make it as attractive as possible. In the terrarium many forms of life can be housed as comfortably as if they were out-of-doors. During the year toads, frogs, tree frogs, bats, salamanders, turtles, snails, butterflies, moths, and other animal life may be kept in it, and the children will find them an endless source of joy.

In spring and fall the preparation of the terrarium for visitors from the out-of-doors will open the way for some good work. In many cases the children will be able to collect the material needed—stones, soil, small plants, ferns, and any growing thing that will live for a while and make a woodsy place for the wild life. There should be a dish

of water when some forms of animal life are in the terrarium. Little children enjoy calling this a pond. Following is an account of a successful terrarium that will illustrate some of its uses:

Children of six, seven, and eight years took active interest in this miniature outdoor world. The bottom of the ter-

A MODEL TERRARIUM Drawn from Photograph

rarium was covered with stones. The children were asked to collect as many different kinds as possible; some were flat rocks, some pebbles, and some were pieces of fossiliferous limestone which aroused much interest when the fossil forms were noticed. The simplest kind of observation of

these stones was made. Next some soil was placed over a large part of the surface of the stones. Then a nook was prepared with moss and ferns. The children were instructed to bring small pieces of different kinds of moss, if possible. A few seedling trees were added, the children being taught the value of thinning seedling trees that are very close

Drawn from Photograph

MANY INTERESTING ANIMALS VISIT THE SCHOOL

together, leaving the strongest room to grow. A small hemlock; a tiny maple; a tulip tree with a leaf or two; a seedling that nobody knew, not even the teacher, were brought to school. The tallest and strongest boy brought a thistle for the butterflies, which gave a good opportunity

to study a troublesome weed; a little maid asked to sow some grass seed for grasshoppers; a young naturalist suggested a water plant for the pond. The vegetation had to be replaced from time to time, but this gave opportunity for the teacher to ask to have an oak tree, a different kind of fern, or some weedy plant, naming a particular kind, in order to give interest to the quest.

During the year many interesting animals were inmates of the terrarium—in fall and spring, toads, salamanders, turtles, caterpillars, butterflies, potato beetles, a little "upside down bat," and other forms of life. Care was taken to avoid housing foes together, such as the turtles, salamanders, and toads. An annex to the terrarium was always on hand for temporary quarters for one of the animals. Demonstrations given by the natural enemies of injurious insects, however, were not avoided. In winter the terrarium was cleaned out and the following guests came into the comfortable quarters for a few days each: A hen, a cock, bantams, a guinea pig, a rabbit, a pigeon, a kitten, a puppy.

The terrarium was made high, because used for children in the lower grades. It is best not to have the animal life handled too much by the little folk. The older boys and girls took special interest in caring for the terrarium, and the younger children looked forward to the privilege in the future.

In this terrarium the toad was the best loved visitor. He more than paid his board and lodging. The teacher knew about toads and so named him Bufo. Every child learned that it was safe to handle Bufo, that he could not share his warts with them if he would; and finally the children took turns in taking him home to spend the night. He thrived, and, if anything, was overfed. Bufo, all motionless, was in the terrarium one day, when a cabbage butterfly evidently took him for a bit of rock or log, lighted on his nose, and was gone in the twinkling of an eye. The children saw this demonstration of his helpfulness in the garden. Since cabbage butterflies and other injurious insects

must go, there is no quicker method than by way of a toad. The children decided that toads would make good assistant gardeners.

The salamanders were very interesting. No other small creatures became greater favorites and gave less trouble than the salamanders. They helped the children to overcome a fear of wriggling things. The most sensitive child soon wanted to handle them and do her part toward taking care of them.

Each form of animal life in the terrarium during the year made its contribution to the education of the children, and many interesting and economic facts were mastered by means of direct observation. The terrarium was the center of nature study interest. The inmates had personality and the children gave them names. There was "Bufo," the toad; the turtle was called "Solomon"; the brown and black caterpillar, "Fuzzy"; the butterfly was "Gauzy"; the bantams, "Nip and Tuck"; the old hen, "Biddy."

In preparing for the coming of the larger forms of animal life the children took much interest. The terrarium was cleaned, borax was scattered over the floor, and over this were spread "rugs" of newspapers made by the boys and girls. A fundamental idea for cleanliness was thus presented in a natural way. While the rugs were being made the teacher spoke of the many uses for borax in the home.

It is worth while to have a terrarium. Any enclosed bit of earth on which things will live and grow will do.

3. An Aquarium. A successfully balanced aquarium is the exception rather than the rule, unless the one who makes and stocks it has been taught how to do it. It is difficult to keep an aquarium balanced, particularly if the children have access to it, and are constantly interfering with the life. Some teachers of wise judgment seem to consider it best to have an aquarium jar and study one form of aquatic life at a time, particularly in the lower

grades. This does not give ideal opportunity to demonstrate aquatic life, but it makes a good beginning. It will interest a teacher who has never had any experience in this work to find how much one fish will contribute to the life of the schoolroom. A teacher not given to exaggeration made the statement that a bullhead in the aquarium jar in school did much toward maintaining discipline. This bullhead was called "Billy," and certainly was worthy of

STUDYING LIFE IN THE AQUARIUM

a name other than the one given him in nature. There was not a characteristic that Billy had that escaped the children. They were allowed to stand about the aquarium jar when lessons were learned, and the teacher said she often wished there was one bullhead for each child. The little sunfishes, sticklebacks, shiners, Johnny darters, and other fishes will survive a long time, if each one is kept by itself, in fresh water, and properly fed. Prepared fish food, a bit of meat, insects, and worms will be best, in quantities that can be consumed in the day. The amount will depend entirely on the size and species of fish and will be best deter-

mined by experiment. Each day remove food not consumed and soon the proper amount can be estimated.

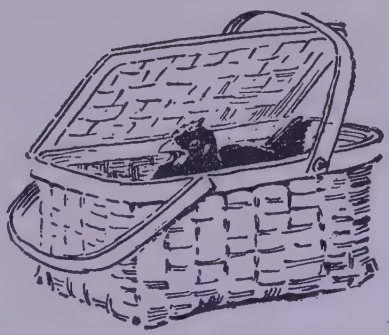
4. A Cricket Cage. This simple apparatus is made with a flower pot and a lantern globe covered with a piece of cheesecloth held in place by a rubber band. Planted to grass seed, it will make a dwelling place for many forms of life—crickets, grasshoppers, daddy long legs, spiders and other small creatures.

CRICKET CAGE

5. A Tripod Lens. This is the best magnifying glass for young children. They will enjoy looking at a house fly, a mosquito, a potato beetle, a bit of moss, a snowflake, a single flower of one of the *Compositæ*, or the heart of a rose.

TRIPOD LENS

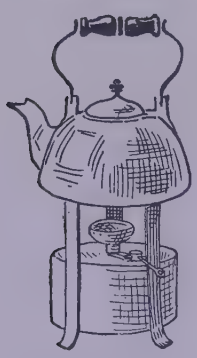
6. Baskets. There is scarcely any limit to the use of baskets in the schoolroom. In the nature study lessons they can be used for flowers, for collecting seeds, and for specimens of stone, soil, and other outdoor things. A dish with a flower holder placed in a basket gives opportunity for the most artistic arrangement of flowers. The large covered basket with two handles is indispensable. Two restless children can be sent with it for some animal for the terrarium—a hen, a rabbit, a little duck. The basket will make transportation safe and easy. It can also be used in many kinds of collecting along wood and wayside.



A COVERED BASKET IS VERY USEFUL

7. Flower pots will be valuable in many ways—for testing seeds, growing plants, and the like.

8. A Teakettle and Spirit Lamp. A teakettle has an intimate association for nearly every child. It is a touch of home that can be brought into the schoolroom. Charles Dickens and Hans Andersen knew the companionship of teakettles and like homely objects. Have the children keep the kettle bright and clean and when used for simple experiments be sure the children hear it sing, that they watch the steam, and learn to know when the water is really boiling.



TEAKETTLE AND SPIRIT LAMP

9. Boxes. A few strong pasteboard boxes will be found useful for keeping specimens and compositions out of the dust. Have them labeled, and arrange the contents of each box neatly.

10. Cheesecloth. As a part of their nature study work the children should be taught how to dust and why dusting is essential. Dusting with a moistened cloth which is washed after it is used is not practiced in many homes. It is a most important thing to learn. See *Nature Study and Life*, page 476. Small pieces of cheesecloth hemmed by the children and kept clean will be useful in taking care of the animal life and in covering cages for insects and the like.

11. Garden Tools. If there is not a garden equipment for use of the school, the teacher should have two or three sets of small but well-made tools. A rake, hoe, and trowel will many a time provide outlet for a restless boy or girl and a needed piece of work near the school building can be done. The tools should always be cleaned and hung up after using. This will give an added lesson that will educate.

12. For The Home. Teach simple table decoration by having one child each week set the table and furnish simple decoration for it from his garden or from wild plant life. Emphasize the advantage of a small, low decoration for the center of the table. Teach the value of the tiny hemlock cones, barberry, bitter sweet, a spray or two of the more

delicate asters and golden rods, and other plants for making the table attractive.

Nature Study Subject-Matter

6. Nature on Every Hand for Study. The following suggestions for subject-matter have been made with as broad a nature outlook as possible. Teachers in the villages can do less than teachers in the country, and teachers in the cities still less than those in the villages. At the same time, there are very few of the topics presented which the city teacher will be unable to use in some way. A touch with nature here and there will go farther than is at all times realized. A city teacher who will read *Nature in a City Yard* by Charles M. Skinner (The Century Co., $1.25), will learn how much of real nature is at hand even in districts in which great buildings seem to meet the sky. Perhaps the teacher in the village has the largest responsibility in this work, because boys and girls in the smaller communities have neither the absorbing interests of the great city nor yet the busy life of the farm. Leisure without guidance is fraught with greatest danger. The more village children can be directed natureward, the better.

The subject-matter has not been graded into first, second, and third year work. Nearly all the suggestions given have been successfully used in some form from the kindergarten to the fourth year. The teacher must decide what to use for each year, and how much. The instruction in the first three grades will not differ greatly in kind, but in degree.

I. NATURAL FORCES AND PHENOMENA

Passengers on the Cosmic sea,
We know not whence nor whither;
'Tis happiness enough to be
In tune with wind and weather.

—L. H. Bailey.

7. Sunshine; Shadow; Dawn; Twilight; Night. It is in the first three grades in school that children are getting much

of the foundation for their attitude toward life. They should be taught to be in tune with wind and weather; with the changes of day and night. Some plan similar to the following will help to accomplish this:

The sun is a great factor in the day. It must not be crowded out by lesser interests. Occasional morning talks should include the place of the sun in the lives of the boys and girls, in the lives of the birds, in the lives of the farm animals and plants. Let the children close their eyes and think of pictures of dawn. How the color comes into the east; the old cock wakes up the young folks and the old folks; the gray light creeps in at the window; the thrush sings; the little brown calf in the barnyard looks around; and the day has begun. How good the sunlight is for every one—for boys and girls and men and women and for all the living things. It comes into our houses to chase out diseases, into the barns to keep them healthful for cows and horses, into the poultry houses so that the hens that do so much for us may keep well. Sweet, fresh air, warmed and purified by the sun, is essential to all life. It must be welcomed into the schoolhouse and the home. Have the children learn the following:

SUMMER SUN

ROBERT LOUIS STEVENSON

Great is the sun, and wide he goes
Through empty heaven without repose;
And in the blue and glowing days
More thick than rain he showers his rays.

Though closer still the blinds we pull
To keep the shady parlour cool,
Yet he will find a chink or two
To slip his golden fingers through.

The dusty attic, spider clad,
He, through the keyhole, maketh glad;
And through the broken edge of tiles,
Into the laddered hayloft smiles.

A TRIP AFIELD

Meantime his golden face around
He bares to all the garden ground,
And sheds a warm and glittering look
Among the ivy's inmost nook.

Above the hills, along the blue,
Round the bright air, with footing true,
To please the child, to paint the rose,
The gardener of the world, he goes.

(Courtesy of Charles Scribner's Sons.)

In teaching sunshine, one must always bring to the mind of the child the possibilities of interest in shadows. Their own little shadows and when they can find them; the shadows of the trees, of the church tower, of the wayside plants, of the currant bushes. While interested in sunshine and shadow, the children will enjoy this poem:

MY SHADOW

ROBERT LOUIS STEVENSON

I have a little shadow that goes in and out with me,
And what can be the use of him is more than I can see.
He is very, very like me from the heels up to the head;
And I see him jump before me, when I jump into my bed.

The funniest thing about him is the way he likes to grow—
Not at all like proper children, which is always very slow;
For he sometimes shoots up taller like an india-rubber ball,
And he sometimes gets so little that there's none of him at all.

He hasn't got a notion of how children ought to play,
And can only make a fool of me in every sort of way.
He stays so close beside me, he's a coward, you can see;
I'd think shame to stick to nursie as that shadow sticks to me.

One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup;
But my lazy little shadow, like an arrant sleepy-head,
Had stayed at home behind me and was fast asleep in bed.

(Courtesy of Charles Scribner's Sons.)

And before going home, the teacher should once in a while lead the children to talk about the oncoming night.

This gives a time for deepening love of home pictures: the mother at the window sewing; the preparations for supper; the sunset; the twilight (this word should become a part of the child's vocabulary); the first star seen from the window. Ask the boys and girls to look at the stars and the following morning ask about a star or planet in the east or the west. Who saw it? Who will look for it to-night? Ask them to have their father show them the Great Dipper, or some simple constellation, that will interest them in looking up into the night sky, and if possible in having father or mother look with them.

8. Rain. The rainy day comes. It should be made the most interesting day of all.

> The soft, gray rain comes slowly down,
> Settling the mists on marshes brown,
> Narrowing the world on wood and hill,
> Drifting the fog down vale and rill.
> The weed-stalks bend with pearly drops,
> The grasses hang their misty tops,
> The clean leaves drip with tiny spheres,
> The fence rails run with pleasant tears.
> Away with care, I walk to-day
> In meadows wet and forests gray.
>
> —L. H. Bailey.

Unfortunately, rain is depressing to many persons who have not learned to be "in tune with wind and weather." The children hear the day called gloomy and disagreeable, from the time they open their eyes. The schoolroom looks dark. On such days the regular program may be changed. Everything should be made neat and clean; the rain is washing everything outside. The teacher is not gloomy. She has learned to love the restfulness of the gray day and has found new wonder in the out-of-doors, when rains and leaden skies change color and spirit in field and wood and highway, or in the city street. Children are imitative. They, too, will meet the rain. How grateful it is to the plants! John has rubber boots and a "slicker." He will like to put out all the little schoolroom plants for an hour or two. How every-

body enjoys hearing the rain fall on the roof! Little heads rest on the desks and with closed eyes, every one listens. Rain on the roof is a kind of music. When boys and girls were little babies, it probably put them to sleep many times. It falls softly on the backs of the robins and on the cows in the pasture. It is filling the rills that fill the brooks that flow on to the rivers.

The rain is raining all around,
It falls on field and tree,
It rains on the umbrellas here,
And on the ships at sea.

—Robert Louis Stevenson.

The young children will enjoy a simple experiment to demonstrate rainfall. The vapor rises. The clouds form.

FORMING RAINDROPS

Moving in the heavens the clouds sooner or later strike cold currents of air and the moisture is condensed, making the raindrops. The illustration will explain a simple way to have the children demonstrate this.

Try to have the rainy day happy in the schoolroom and send the children home with new joy in their hearts, with new understanding of gray skies, and glad to have the raindrops fall on their upturned faces.

9. Snow.

With windy haste and wild halloo the sheeting snow comes down
And drives itself through bush and swale and leagues of stubble brown.
Blessings on the waiting fields when the sheeting snow comes down.

—L. H. Bailey.

When the first snow falls, if possible let the children run out into it for a few minutes. The whole magic of this winter joy should be theirs. Have them notice the snowflakes that fall on their coats. Let them look at them through the lens. How many points has each snowflake? Through the days of freezing and thawing, simple observations will suggest themselves to the teacher. The icicles will hang from the roofs. The trees and plants will hold the snow in different ways. A bird's nest will be filled with the white flakes. One side of the tree trunks may be snow laden; which side? Why? The brooks will freeze along the edges first; why?

The midnight frolics of the wood folk are revealed; how? The tracks of rabbits and mice are soon learned by little children who have an opportunity to see them a few times. The telltale snow has an interest. The teacher might occasionally ask such questions as the following: When it is snowing very hard and the garden path has not been shoveled, can you tell whether Grandfather or Aunt Jane or little Bob came to your kitchen door? How? Can you tell whether Rover jumped over the fence or came in at the gate? Can you tell from the tracks of sparrows whether they hop or walk? Watch Bunny hurry over the snow; what kind of tracks does he make?

There are a few rhymes of winter that children will always love and that are worth while to memorize, one of which is:

THE LITTLE ARTIST

Oh, there is a little artist
  Who paints in the cold night hours
Pictures for wee, wee children,
  Of wondrous trees and flowers.

Pictures of snow-capped mountains
  Touching the snow-white sky;
Pictures of distant oceans,
  Where pygmy ships sail by;

Pictures of rushing rivers,
  By fairy bridges spanned;
Bits of beautiful landscapes,
  Copied from elfin land.

The moon is the lamp he paints by,
  His canvas the window-pane,
His brush is a frozen snowflake;
  Jack Frost is the artist's name.
  —From *Nature in Verse* (Silver, Burdett & Co.)

The above will suggest some teaching on the work of the frost. Practical things will suggest themselves in this connection through the winter days. The protection of animals and crops and many other farm practices have to do with frost. Have the children get into the spirit of letting Jack Frost in often by airing the schoolroom and keeping the windows of their bedrooms open at night.

10. Clouds. Days without clouds are rare; yet there is no monotony in cloudland. The variations in size and form are endless. What child has not lain on his back in the sweet summer meadow and watched a particular cloud in its passage across the sky and in its gradual change of form? His imagination has seen strange faces and figures in the clouds, and they opened a new realm of thought to him. He can learn how clouds are formed and can wonder as they appear and disappear.

There are the fall clouds, so full of the promise of keen, cold Thanksgiving weather. Many a time the little children should be taken out to stand a few minutes under the

changing skies, considering whether the clouds might bring rain or snow or whether they might be blown over by great winds. The teacher need make no effort to express enthusiasm. If a cloud is beautiful the little child will respond to it, and he should be kept near to the things that he looked at even before his school days. It is worth while to be weather wise, and interest in clouds and in the changes of temperature will help in this.

11. Wind.

Learn to love the music of the wind. It is a voice that never sings false. You are never small when you listen to it.—SKINNER.

There is something clean and wholesome about the wind, and it can be made a valuable character builder. Little children love to brace themselves against it and to feel it blow the color into their cheeks and the cobwebs out of their brains. There is no other force in nature that inspires such confidence and freedom as the wind.

How attractive the old weather-cock is! If there is one in sight let the children have an opportunity to discuss it with the teacher. The older children can tell the direction of the wind and learn some of the things that the weather-cock can teach. Let them learn Stevenson's poem, *The Wind*. It is full of good spirit:

THE WIND

ROBERT LOUIS STEVENSON

I saw you toss the kites on high
And blow the birds about the sky;
And all around I heard you pass,
Like ladies' skirts across the grass—
O wind, a-blowing all day long,
O wind, that sings so loud a song!

I saw the different things you did,
But always you yourself you hid.
I felt you push, I heard you call,
I could not see yourself at all—
O wind, a-blowing all day long,
O wind, that sings so loud a song!

O you that are so strong and cold,
O blower, are you young or old?
Are you a beast of field and tree,
Or just a stronger child than me?
O wind, a-blowing all day long,
O wind, that sings so loud a song!

(Courtesy of Charles Scribner's Sons.)

How many teachers have considered the value of kite flying? The hand work; the fresh air; the part played by the wind; the background of clouds; the solitary amusement.

12. Sound. Nature has much to contribute to one whose sense of hearing is trained. The ear should be cultivated, and this should be done in childhood. Many of the most wonderful sounds are lost to all but the one who truly listens: the rustling leaf; the fall of an apple; the voice of the tree frog; the early morning breeze; the plash of the rill.

Simple lessons in listening may be given to advantage in the lower grades, and they are particularly valuable in the out-of-door work. The autumn sounds are all interesting and many in spring are full of beauty. Let the children close their eyes and listen to the sounds that come in at the open window. Such a test made in a third grade class led to the following list: a crow; a cat; a town clock; Jimmie's little sister crying; a robin; a bumblebee; a sneeze; horses' feet on the road; a hen; a little chippy bird; Mr. O'Brien's cough.

Have the children go out-of-doors once or twice a week for a few minutes and listen. They will get a breath of fresh air and their power to hear will increase.

II. LANDSCAPE FEATURES

13. What to Teach. How much that child eyes looked upon becomes the near companion of maturer years! The stately mountain, or the hill that to the child looked like one; the sunlit valley; the woodlot; the forest; the brook; that long white road leading to another world of interest

and perhaps mystery. Any landscape feature can be made the subject for good nature study, ever changing as it is in color, in the life about it, often in its general character.

A LANDSCAPE STUDY

It is in connection with landscape features that the field trips are most valuable. Large numbers of teachers throughout the United States and Canada have been successful in field trips with little children, and at least one or two should be made each year. A walk with the teacher! this is one of the greatest of all joys. A trip to the autumn wood; to the brook in springtime; along the white bordered road in winter. To spend an afternoon on "our hill," in "our wood," or beside "our brook" with the plants that grow there; the round of life that little children love.

14. A Type for Study. Sometimes it is well to select one feature for the year's work. This may be a brook. Liberty Hyde Bailey says:

"A brook is the best of subjects for nature study. It is near and dear to every child. It is a world in itself. It is an epitome of the nature in which we live. In miniature it illustrates the forces which have shaped much of the

TROPICAL LANDSCAPE
POLAR LANDSCAPE

earth's surface. Day by day and century by century, it carries its burden of earth-waste which it lays down in the quiet places. Always beginning and never ceasing, it does its work as slowly and as quietly as the drifting of the years. It is a scene of life and activity. It reflects the sky. It is kissed by the sun. It is caressed by the winds. The minnows play in the pools. The soft weeds grow in the shallows. The grass and the dandelions lie on its sunny banks. The moss and fern are sheltered in the nooks. It comes one knows not whence; it flows one knows not whither. It awakens the desire for exploration. It is a realm of mysteries. It typifies the flood of life. It goes 'on forever.'

"In many ways can the brook be made an adjunct of the schoolroom. One teacher or one grade may study its physiography; another its birds; another may plat it. Or one teacher and one grade may devote a month or a term to one phase of it. Thus the brook may be made the center of a life-theme."

Where does the brook begin? No one knows, perhaps. The geography of the brook will need much study. How wide is it at its widest point? Are there islands in it? Peninsulas? Have the children count the different kinds of plants that grow in the brook and along its banks. Take some specimens back to the school. If the teacher does not know the names of these plants, the quest for the names will be interesting. Any botany teacher will help, or specimens can be sent for identification to an agricultural college or experiment station.

The animal life of the brook may be studied throughout the year, after the field trip gives the first interest in it. New discoveries should always be commended and the young naturalist encouraged to himself show what he has found and where he found it. The French glass bottles will help in this work. (See page 9).

Brook joys should not be neglected in this lesson. How the cattle like to stand in the cool water and to drink from it! How cheerfully the ducks become a part of its rippling

surface, and the white sunlight falls on their soft feathers and yellow bills! How little children love to wade in it!

And best of all is the music of a running stream. Whittier, speaking of his boyhood's brook, says:

> The music of whose liquid lip
> Had been to us companionship;
> And in our lonely life had grown
> To have an almost human tone.

Have the children listen to this music some spring afternoon. Teach them some of the lines from Maurice Thompson's *In the Haunts of Bass and Bream*, (used here by permission of his publishers, Houghton Mifflin Co.)

> Go with me down by the stream,
> Haunt of bass and purple bream;
>
> Feel the pleasure, keen and sweet,
> When the cool waves lap your feet;
>
> . . . . .
>
> The busy nuthatch climbs his tree,
> Around the great bole spirally,
>
> Peeping into wrinkles gray,
> Under ruffled lichens gay,
>
> Lazily piping one sharp note
> From his silver mailèd throat;
>
> And down the wind the catbird's song
> A slender medley trails along.
>
> Here a grackle chirping low,
> There a crested vireo;
>
> Deep in tangled underbrush
> Flits the shadowy hermit-thrush;
>
> Cooes the dove, the robin trills,
> The crows caw from the airy hills;

Purple finch and pewee gray,
Bluebird, swallow, oriole gay,—

Every tongue of Nature sings;
The air is palpitant with wings!

. . . . .

Bubble, bubble, flows the stream,
Like an old tune through a dream.

. . . . .

A big blue heron flying by
Looks at me with a greedy eye.

I see a stripèd squirrel shoot
Into a hollow maple-root;

. . . . .

Bubble, bubble, flows the stream,
Like a song heard in a dream.

The suggestions for the brook will help the teacher to seek the possibilities for study in some other natural feature that may be present instead of a brook.

III. PLANT STUDY

15. Gardens.

A garden is a lovesome thing, God wot!
Rose plot
Fringed pool
Ferned grot
The veriest school
Of peace; and yet the fool
Contends that God is not—
Not—God! in gardens! When the eve is cool?
Nay, but I have a sign;
'Tis very sure God walks in mine.

—Thomas E. Brown.

In many schools little children are kept in close rooms all day long—little children between the ages of six and

nine years; away from the things that are their birthright, air and sunshine and robin note and green things growing. What will the generations to come think of us when they learn what was done with the little children of our time by way of education? The children of the future will meet no such fate, but through gardens useful and gardens beautiful they will learn many of the essentials of life; they will become a part of things worth while.

All children, even little folk, should work with their hands every day. All such work should be as carefully supervised as work in arithmetic, and results should be as exact. A garden offers the most wholesome form of work. Every educator who makes effort to strengthen public opinion in favor of gardens for boys and girls is making a valuable contribution to society. Every teacher who interests a child in having a garden is helping him to a better manhood.

The large school garden has failed in many places and it will continue to fail until it is made a part of the school equipment, and is financed in a way to secure success. It should be a place, when school is in session, that will provide work in the open air and also provide plant materials for the many lessons in which such can be used. It should be the laboratory for much of the nature study work. A garden with its vegetables and flowers; its bush fruits; grapevines; herbs; observational plats of grains and grasses; wild gardens; its sundial! What teaching could come by means of such a laboratory, and what development there would be in it for teachers and pupils! The school garden need not be divided into individual plats for boys and girls to own, but it should be a place in which the pupils are taught the fundamentals of garden-making for their home gardens. The school garden should be maintained during vacation and become a center of neighborhood interest. Gardening in connection with schools should be conducted with dignity and responsibility, or not attempted. Many school gardens have been immoral in their influence.

There are thousands of teachers in this country who are teaching children to live by means of outdoor life, including a garden. This is hopeful. No matter how small the piece of ground near the schoolhouse; if teachers and children work together to make it productive the educational purpose is accomplished. If the children learn from this piece of work how and what to plant, and a few fundamental practices relating to soils in gardens, they will want a garden at home. This is a result that counts. If boys and girls begin young enough to work in a garden, and do thorough work, however simple, for three or four consecutive years, it will hardly be possible to keep them out of one. Gardening is a habit and what a valuable habit it is to form! What a wholesome and even holy resource it will give in later years, for in all truth God walks in gardens!

One may do much gardening on a piece of ground two feet square. A window box may provide a garden in cities. A flower pot may give opportunity to educate by means of a plant. A few bulbs indoors or out will provide joy and awaken new thought in ways that experience alone can fully demonstrate. If the teacher call a mothers' meeting and explain the viewpoint of educators on the value of a garden in the education of boys and girls, the co-operation of parents will often be secured; and encouraged by teachers, parents, and public spirited citizens, a home garden will appear here and there in the neighborhood.

There is probably not a community in the world in which there is not at least one good gardener or a person who was at one time a gardener. The teacher who wishes to get ready for work of this kind should list a few garden plants in her notebook and consult a gardener or florist about them. A personal talk with a grower of plants will mean more than any number of printed pages. Gardening can not be taught without some preparation, any more than arithmetic. It is so worth while to make a thorough preparation for teaching it.

16. Plants for the School Garden. Make a selection of plants from the list given in these pages for the first school garden. Whatever has real interest for the teacher will interest the pupils. Take the list to some one who knows the subject and consult him as to the probability of success in the selection, the varieties to grow in the locality, the preparation of the soil, the questions of moisture, sunlight, time of maturity, and the like. When such knowledge has been collected and thoughtfully considered, the teacher may give instruction in gardening. The facts relating to specific plants given here will serve as reference. The list was suggested by C. E. Hunn,[1] gardener, and has been worked out in connection with children's gardens. The time of planting will vary in different localities; also the varieties to be grown and the hardy character of the plants.

A list of garden vegetables, the seed of which may be sown as soon as the ground is fit to work in the spring:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Asparagus	April 2	1 inch	Light Loam
Beets	"	2 "	"
Carrots	"	1 "	"
Chicory	"	1 "	"
Cress	"	½ "	"
Endive	"	1 "	"
Kale	"	1 "	"
Kohl-rabi	"	1 "	"
Leek	"	1 "	"
Lettuce	"	1 "	"
Mustard	"	1 "	"
Onion	"	1 "	"
Parsley	"	½ "	"
Parsnips	"	1 "	"
Peas	"	2½ "	"
Radish	"	1 "	"
Rutabaga	"	1 "	"
Salsify	"	1 "	"
Sea kale	"	1 "	"
Spinach	"	1 "	"
Turnip	"	1 "	"

[1] Foreman of Grounds, New York State College of Agriculture, Ithaca.

A list of garden vegetables, the seed of which should not be sown until the ground is warm and all danger of frost is over:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Beans	May 10	2 inch	Light Loam
Corn	" 10	2 "	"
Okra	" 20	1 "	"
Pumpkin	" 10	2 "	"
Squash	" 10	2 "	"

A list of popular perennials. Plants to be grown the previous summer:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Abutilon (Flowering maple)	May	3 inches	Any well-enriched, well-drained soil. Light loam preferable.
Aquilegia (Columbine)	April	3 "	
Bellis perennis (English daisy)	"	2 "	
Campanula (Canterbury bells)	"	3 "	
Canna	May	4 "	
Delphinium (Larkspur)	April	3 "	
Digitalis (Foxglove)	"	4 "	
Gaillardia (hardy)	May	3 "	
Althaea (Hollyhock)	April	4 "	
Poppy (hardy)	"	3 "	
Rudbeckia (Cone flower)	May	4 "	
Helianthus (Sunflower, hardy)	"	3 "	
Sweet William	"	3 "	
All hardy pinks	"	3 "	

A list of shrubs for garden borders: Almond (flowering), cornus in variety, elder, forsythia, hydrangea, honeysuckle (bush), japan quince, kerria, lilac in variety, mahonia, privet, roses in variety, snowball in variety, spirea in variety, sumac, weigelia, witch-hazel, evergreens, dwarf thuja, retinispora, junipers, Norway spruce, dwarf pine.

A list of early vegetables that should be started inside in April, and the plants set out as soon as the ground is fit: Brussels sprouts, cabbage, cauliflower, celery, celeriac.

A list of late vegetables, the seed of which should be started in April and the plants set out after the tenth of May: Cucumber, eggplant, melon, pepper, tomato.

Annual flowers. The seed should be sown after the danger of frost is over. The best results are obtained if the plants are started in the house in April, and set out after the tenth of May.

Variety	Time of Sowing	Depth of Sowing	Soil Best
Antirrhinum (Snapdragon)	May 5 or after	1 inch	Light Loam
Aster	" "	1 "	"
Celosia (Cockscomb)	" "	½ "	"
Cosmos	" "	1 "	"
Dahlia	" "	1 "	"
Lantana	" "	1 "	"
Myosotis (Forget-me-not)	" "	1 "	"
Ricinus (Castor oil bean)	" "	2 "	"
Salvia (Scarlet sage)	" "	1 "	"
Schizanthus (Butterfly flower)	" "	1 "	"
Mathiola (Stocks)	" "	1 "	"

Annual flowers. Seeds to be sown early.

Variety	Time of Sowing	Depth of Sowing	Soil Best
Adonis (Pheasant's eye)	April or early May	1 inch	Light Loam
Ageratum	" "	½ "	"
Alyssum	" "	½ "	"
Amaranth	" "	1 "	"
Brachycome (Swan river daisy)	" "	½ "	"
Browallia (Amethyst)	" "	1 "	"
Calendula (Pot marigold)	" "	1½ "	"
Calliopsis (Coreopsis)	" "	1 "	"
Aethionema (Candytuft)	" "	½ "	"
Carnation	" "	1 "	"
Centaurea (Bachelor's button)	" "	1 "	"
Chrysanthemum (annual)	" "	1 "	"
Clarkia	" "	1 "	"
Dianthus (China pink)	" "	1 "	"
Euphorbia (Snow-on-a-mountain)	" "	1 "	"
Gaillardia (Blanket flower)	" "	1 "	"
Godetia	" "	1 "	"
Gypsophila (Baby's breath)	" "	1 "	"
Helichrysum (Everlasting)	" "	1 "	"
Lobelia (Cardinal flower)	" "	½ "	"
Tagetes (Marigold)	" "	1 "	"
Mignonette	" "	½ "	"
Nasturtium	" "	2 "	"
Nicotiana	" "	½ "	"

Annual flowers. Seeds to be sown early.—*Continued.*

Variety	Time of Sowing	Depth of Sowing	Soil Best
Nigella (Love-in-a-mist)	April or early May	1 inch	Light Loam
Petunia	" "	½ "	"
Phlox D	" "	1 "	"
Eschscholtzia (California poppy)	" "	½ "	"
Poppy, Shirley	" "	½ "	"
Portulaca	" "	½ "	"
Pyrethrum	" "	1 "	"
Salpiglossis	" "	1 "	"
Scabiosa (Mourning bride)	" "	½ "	"
Lathyrus (Sweet pea)	" "	4 "	"
Verbena	" "	1 "	"
Zinnia	" "	1 "	"

In order to have a good garden, each plant should have room for its fullest development, and since most of the seeds of garden flowers and vegetables are small it is almost impossible to sow the seeds sparsely enough so that each plant will grow to perfection. Since this is the case, the plants must be "thinned," and either thrown away or transplanted to some other part of the garden. If the thinning is done in cool, cloudy weather, the seedlings may be transplanted with great ease; but if it is done in dry, sunny weather, the seedlings must be shaded after being set out. It is best to thin the plants when they are small, before they have become crowded, but if one wishes to save them for transplanting they may be left until large enough to handle. The following will be found helpful to young gardeners in thinning and transplanting:

1. *Flowering plants that should be four inches apart:* Alyssum, ageratum, balsam, candytuft, lobelia, pansy, poppy, portulaca.

2. *Flowering plants that should be six to eight inches apart:* Amaranthus, browallia, carnation, centaurea, dianthus, eschscholtzia, gaillardia, mignonette, myosotis, phlox D.

3. *Flowering plants that should be twelve inches apart:* Aquilegia, aster, campanula, calliopsis, colosia, helichrysum, heliotrope, larkspur, marigold, nasturtium, "drop," nigella, petunia, salpiglossis, scabiosa, verbena, zinnia, sweet william.

4. *Flowering plants that should be eighteen to twenty-four inches apart:* Canna, chrysanthemum (annual), cosmos, dahlia, delphinium, digitalis, gypsophila, nicotiana, phlox (hardy), salvia, rudbeckia, schizanthus, tritoma.

5 *Vegetables that should be six inches apart:* Beet, celery, lettuce, parsnip, parsley, spinach, salsify, turnip.

6. *Vegetables that should be twelve inches apart:* Bean, cabbage, cauliflower, eggplant, endive, kohl-rabi, pepper.

7. *Vegetables that may be sown thickly:* Carrot, leek, onion, pea, radish.

8. *Vegetables that should be three to four feet apart each way:* Bean (pole), corn, cucumber, kale, melon, squash.

Vines. Make a list of every vine, wild and cultivated, that has thrifty growth in your locality. Find out which will grow most quickly and which are most hardy. Call a meeting of parents and encourage them to help the children in planting vines about the home and school. Vines have a good influence in any community.

17. Interest in Soils. In connection with the garden lessons, however small the garden, the teacher should take the opportunity to interest the children in soils. Simple instruction in rocks and minerals can be given at this time, if the teacher has the background for the teaching. Young children can see the way in which soil is being formed from rocks. They can note different degrees of hardness in the rocks, and see some of the forces that are wearing them away.

Have the children bring samples of soil from the roadside, garden, wood and other neighborhood places. They can be led to observe the different textures and something of the composition. They can learn what makes a soil rich, and the relation of moisture to the different soils. This work should include familiarity with soils and develop observations that will prepare the boys and girls for more serious work along this line in the fourth and fifth grades.

18. An Individual Plant. Every child in the primary grades should have a plant of his own during the year. The boys and girls can provide their own flower pots and in many cases their own little plants. The teacher will find ways to secure a plant for all who have not been able to get one. Small geraniums are as satisfactory as any. Teach the children how one small red geranium and very white curtains make a room cheerful. Teach them that one thrifty plant in clean surroundings will give more joy than many that are not given good care.

Have a plant afternoon and give each child an opportunity to see the individual plants belonging to the class. Which plants look thrifty? What makes a plant look thrifty? With his own plant on the desk have each child write a few statements about it: How many leaves it has; how many buds; how many blossoms; the color of the blossoms; the shape of the leaves. Do not let this exercise become tiresome. Except when real interest can be maintained, nature study records belong to the more advanced grades.

Have the children take their individual plants home for a month and then bring them to school some Friday afternoon. Which plants show the most care? A little wholesome competition with a prize or two might be worked out in connection with such an exercise.

Another valuable plant study might be conducted as follows: Let each child have a flower pot in which good soil is placed. Have him know why the soil is good. Then give the boys and girls a choice of seeds to plant. There should be seeds of vegetables, flowers, and even trees. Some small trees do not look like their parents. The seeds of the ten trees discussed on pages 39-40 will doubtless germinate in flower pots. If there is room and proper heat, keep the individual gardens in the schoolroom; if not, they may be taken home. There will be some interesting and even exciting results. A small green or red watering can will add much to the care of these gardens.

19. Trees. One way to prepare to teach trees might be for the teacher to list in her notebook the trees here given, or any other list, and to set herself the task of trying to see each tree, to learn the form of leaf, the kind of blossom, and the fruit. The children in the third grade and even in the second will help in the quest. Begin observations on one of the trees in the neighborhood. Have a box in the schoolroom and encourage the older children to write the observations they make each day, sign the record, and place in the box. At the end of two weeks it will be interesting to learn who has made the largest number of observations.

LIST OF TREES

Conifers:	White pine	*Hardwoods:*	Hard maple
	Norway spruce		Soft maple
			Elm
			Beech
			Red oak
			Basswood
			White ash
			Horse chestnut

Descriptions of these trees can be found in any good work on the subject. First study the tree. Have the children make inquiries of their parents as to whether these trees can be found in the neighborhood.

Many teachers are interested in elementary lessons in forestry. Quick reference on this subject may not be easily found. Some of the following suggestions will, therefore, be helpful.

If seeds of the above trees are used for growing seedling trees in flower pots, the following facts, given by Professor Bentley,[1] forester, should be considered:

"The seeds of the soft maple and elm mature in early summer, and should be gathered and sowed immediately if any germination is to be expected. Of the other hardwoods, the basswood and red oak may take some little time to germinate, and perhaps to secure the best results, should be stratified as follows:

"To stratify seeds, they should be placed in a pit out-of-doors. This pit should be situated on raised ground, so as to insure good drainage, and it is often desirable to provide protection against mice and squirrels by means of wire netting or boards. Cover the bottom with a layer of clean sand, two or three inches deep. On this spread a layer of nuts, then another layer of sand, and so on until all the seeds are stored. The whole should be covered with earth to a depth of four to six inches. A mulch of leaves and hay spread on top, and boards or stones to prevent washing, may be an

[1] Assistant Professor of Forestry, New York State College of Agriculture, Ithaca.

advantage. The freezing that takes place during the winter will not injure the seeds, but will assist in opening the hard shells, thus making germination easier in the spring.

"The best kind of soil for germinating seeds is a rich, sandy loam, which will hold the moisture fairly well and yet not be so damp as to cause mildew or molding of the seeds. Ordinarily a sandy loam soil into which has been introduced, and thoroughly mixed, some well decayed leaf mold, such as is found in the woods, makes a very good seed bed. If the pots are kept in the schoolhouse, they should be placed in a south window where they will get plenty of light, and doubtless the temperature of the room, together with the sunlight, will be enough to secure germination. It will sometimes help the germination of seeds to cover the soil with a light covering of leaves or straw, in order to conserve the moisture and heat in the upper layers of the soil. This covering may be removed as soon as the seeds germinate and the seedling breaks through the surface of the ground.

"With the exception of the soft maple and the elm, the seeds of the other trees may be collected in the fall, between September 15 and October 15. The children will have to watch the trees in order to obtain the seed before it is scattered and distributed by the wind."

Make special study of the evergreens in the primary grades. The teacher can get ready for this work at any time of the year. First collect specimens of every kind of evergreen that grows in the neighborhood. Secure the help of the older boys and girls for this. They are always ready to help the teacher. The little children will help with much enthusiasm, for are not the evergreens used for Christmas trees? Are not the boys and girls on the lookout for one for a Christmas tree for the birds?

As each specimen is collected, the teacher should endeavor to identify it either by consulting a tree book or by sending the specimen to a teacher of botany in high school or college.

Fruit trees will provide a number of valuable lessons for primary grades. Any young owner of a fruit tree is being

A CHRISTMAS TREE FOR BIRDS AND ANIMALS

educated through its development, and encouragement to grow one should be given. An apple tree affords a great deal of material that teachers and children will find interesting—the fruit in autumn, the blossoms in spring time, and the animal life in and about it. Boys and girls like apple tree blossoms, leaves and fruit. Robins find here a good place for a nest. Learn the different kinds of apple trees to be found in the neighborhood. Discuss the favorite one and why it is the favorite. Does any one in the third grade know what we would have to do to produce apple trees similar to it?

The young children will be interested in the story of Johnny Appleseed. This story is old, but ever new to the children, and the lesson it teaches is permanent.

There are some good memory selections that will help the children to a new interest in apples and apple trees, among which should be considered the following extract from a poem by L. H. Bailey:

> For I planted these orchard trees myself
> On hillside slopes that belong to me;
> Where visions are wide and winds are free
> That all the round year might come to my shelf,
>
> And there on my shelves the white winter through
> Pippin and Pearmain, Rambo, and Spy,
> Greening and Swaar and Spitzenburghs lie
> With memories tense of sun and dew.
>
> They bring the great fields and the fence-rows here,
> The ground-bird's nest and the cow-bell's stroke,
> The tent-worm's web and the night-fire's smoke,
> And smell of the smartweed through all the year.

20. Weeds. It is most important that even young children should take an interest in the plants that have relation to agriculture. Weeds are quite as interesting for study as other plants. They can be found everywhere. They produce many seeds which are distributed over the country in most interesting ways. The seeds can be planted in flower pots in the schoolroom. The children can be taught to find

weed seeds among the seeds of grains and grasses that farmers plant. The boys and girls should learn why it is important to keep gardens, fields, and highways free from weeds. This subject can be connected with civic interest and has relation to neighborhood co-operation.

In preparation for her work, a teacher should have knowledge of at least ten common weeds and try to know each one if it appears in the locality. It is not easy to obtain material on weeds, and therefore the following information prepared by Paul J. White, agronomist, is given:

"Daisy. Everybody knows the wild daisy, with its blossom of white ray flowers and yellow center. It is an attractive plant, but very weedy in character. It is most common in old meadows and pastures. It is also common along roadsides, but seldom appears in cultivated fields.

"The daisy lives several years. The plant increases in size by short runners or offsets. It also produces numerous seeds. These often are found in grass and clover seeds, and are sown by the farmer.

"In meadows the only economical way to get rid of daisies is to plow up the field and plant a cultivated crop. They may be partially crowded out of pastures by inducing a better growth of grasses and clovers.

"Wild Mustard. This is often called charlock. It is a weed of wide distribution. Its length of life is one season. The plant grows from one to three feet high, and has bright green leaves which are covered with many hairs. The flowers are bright yellow. The stem has a purple spot where it branches. The seeds are small and dark brown, or sometimes reddish black in color. They have been known to grow after lying in the ground for more than twenty years.

"Mustard, when young, is easily killed by cultivation. It should never be permitted to produce seeds on the farm. Mustard often grows in crops which can not be cultivated, such as oats. In fields of small grains it is destroyed by spraying with copper sulphate or iron sulphate, while the plants are but two or three inches high. Ten pounds of

copper sulphate or one hundred pounds of iron sulphate are dissolved in fifty gallons of water, and are sufficient to cover one acre. This spray does not injure the grain crop.

"Canada Thistle. Perhaps no weed in the northern latitudes has given more trouble than this one. It may be distinguished from other thistles by the character of the parts below ground. Six or eight inches below the surface, root stocks are sent off which produce new plants in abundance. The Canada thistle produces many seeds which are common in grass and clover seeds.

"This thistle occurs in pastures, meadows, and in cultivated fields. When sod land in which the weed occurs is plowed, the furrow usually does not go deep enough to turn up the roots. Consequently they continue to grow in the cultivated crops and even after the land is again seeded to grass. The most practical method of control consists in very thorough cultivation. No thistles should be allowed to appear above ground. A plant can not live unless it can produce leaves and stems, as the green parts above ground manufacture food which supports the plant.

"Orange Hawkweed. Large areas of the northern country are entirely overrun with this pernicious weed. It is especially common in old pasture lands. It may be known by its orange-colored flowers and by its creeping habit. The leaves all start from near the ground and are covered with fine hairs. The plant lives from year to year, producing many new plants by means of runners, in a manner similar to that of the strawberry.

"Good farming methods generally succeed in exterminating this weed. If the plants are plentiful, the land must be plowed and reseeded after growing one or two cultivated crops. Where the plants are found only here and there a sharp hoe may be used to cut them off just beneath the surface. Salt is sometimes employed to destroy these weeds. Twenty pounds per square rod should be used. It is applied broadcast while the dew is on. This amount of salt will not injure grasses.

"Wild Morning-Glory or Bindweed. There is probably no more dangerous weed than this one. It is widely distributed, although not plentiful in most sections. The plant has a twining habit, like the garden morning-glory. The blossoms resemble those of its cultivated relative. They are pink, and about one and one-half inches across. This weed spreads rapidly by means of underground stems. Very small pieces will grow if carried from place to place. They are often scattered by means of farm tools, such as cultivators, which run through a patch of the plants.

"The only practical method of controlling bindweed consists in thorough cultivation. The use of salt or other chemicals is of no avail. The land must be carefully plowed and some hoed crop planted. The weeds must not be permitted to appear above ground. Frequent tillage with a broad-shared cultivator will prevent any growth.

"Dandelion. The dandelion has qualities which enable it to perpetuate itself. The main part of the plant grows very close to the ground, so that even the lawn mower does not damage it. At certain times in the season the blossoms themselves are so close to the surface that the machine passes over them without damage. Before the lawn is clipped again seeds have matured and have flown away to find a new home in a neighboring lawn. The plant lives many years, if not disturbed.

"Dandelions are generally troublesome in the eastern states in lawns only. In the far west they are one of the worst weeds in irrigated meadows. They can not be killed by spraying. They must be killed with a spud or other sharp, narrow-bladed tool. They should be cut off three or four inches below the crown. Even with this treatment they will often send up new shoots. Well rotted manure or other fertilizer applied to the lawn or meadow will so encourage the growth of bluegrass that the dandelion will not appear so conspicuously.

"Wild Carrot. This weed is related to the common carrot, as may be observed from the odor of the roots. Its

white, flat-topped flowers are conspicuous in meadows, especially late in the summer. When the meadow is mown the weed is cut off three or four inches above ground. Several branches are produced where there was but one before. These branches all produce blossoms at the tips. Each blossom matures many seeds, which are distributed in clover and timothy seeds. They have been known to lie dormant in the ground for several years.

"Wild carrot lives but two years. It does not produce seeds the first year. If allowed to mature, the plants break off during the winter and blow across the snow to neighboring farms, scattering seeds as they go. Where very plentiful, the field should be broken up and a cultivated crop grown. The young plants are easily killed. If there are only a few in the field, they should be pulled by hand.

"Lamb's-Quarters. This weed is found everywhere. It is especially troublesome in cultivated fields and gardens. It has no showy flowers. The blossoms are small and green. The seeds are very small and are common in farm seeds. The leaves and young stems of the plant are covered with peculiar white mealy particles.

"It is easy to rid a field of lamb's-quarters if thorough cultivation is practiced while the plants are young. Harrowing small grains or shallow cultivation of hoed crops, such as corn or potatoes, will destroy countless numbers. In some places the plant is used for feeding pigs. It thus takes the name of pigweed. It is also frequently used for greens.

"Sheep Sorrel. Sheep sorrel is widespread, and is increasing very rapidly. Its greatest damage is done in sandy soils. When once well established, it is almost impossible to destroy it. The plant grows about one foot in height. It has small, inconspicuous flowers. The leaves are arrow-shaped, about one inch long. The plant bears many small, triangular-shaped seeds which are one of the most common impurities of clover seed. It also spreads rapidly by creeping stems.

"As sheep sorrel occurs most commonly in wornout pastures and meadows, the best method of control consists in plowing the field. The land should be fertilized and well tilled for two or three years. Sheep sorrel is said to be destroyed by applying lime, but this is a mistake. It will grow as well where lime is present as in an acid soil.

"Quack Grass. This grass has some value as a hay grass, yet it is a most dangerous weed. Aside from the wild morning-glory, it is perhaps the most difficult weed in this list to control. It is found most commonly in rich meadow land and in gardens. It takes the place of more useful grasses. It spreads rapidly from year to year by means of underground stems. These become fastened to farm tools and are carried from place to place. A very small piece of the root will grow and produce a new plant.

"The best method of controlling quack grass seems to be as follows: It is either pastured until midsummer or a crop of hay is cut. The land is then plowed shallow during the hot weather. At frequent intervals the field is harrowed until freezing weather. The roots are thus exposed to the sun and wind. The next year a hoed crop should be grown. The plants which escaped the severe treatment of the previous year will be killed by cultivation."

Weeds for Schoolroom Study. In beginning the study of weeds in the lower grades the teacher should have a few of the children bring specimens of plants that they consider weeds. These should be placed on the nature study table until the teacher is ready to use them. Some plants that are not weeds will be brought in by the little folk, but many boys and girls have helped their fathers plant gardens and will know a number of weeds. From the specimens brought into the schoolroom the teacher may give lessons on the few that are most troublesome throughout the country, and in the third grade the boys and girls may be taught the best methods of exterminating them.

21. Grains and Grasses. Very young children, particularly in the country districts, will, if properly taught,

become much interested in the grains and grasses that are found on the farm lands, and city teachers can often secure and use material of this kind to advantage. Grains and grasses relate to life, whether in the city or the country. They are strangely and wonderfully made, and are often very beautiful in color. Children who know something of the animal life on the farm will be interested in the grains and the grasses that are used in feeding the stock. Even little folk help in the harvest and know how the crops are used.

Have a simple exhibition of all the grains and grasses to be found in the neighborhood. Test the knowledge of the children as to names, where grown, and what each is used for. Have them keep some seeds and plant them in flower pots. In the third grade have the children give a simple history of wheat from the time it is sown until it is made into bread.

The most interesting field plant is the corn. Consider the structure and color. Note the brace roots, the leaves, the tassel, the silk, the ear. How many kinds of corn can be found in the neighborhood? How are the various kinds used? Who can bring to school the most perfect ear of any one kind of corn?

A charming selection from *Hiawatha* for the children to learn is that which refers to Mondanim, the Indian corn. Consider the educational value there would be for the children who have the opportunity to recite this out in a corn-field.

22. The Autumn Harvest of Orchard and Garden. The lessons in plant life connected with the autumn harvest are among the most attractive. Small exhibitions of fruit and vegetables can be organized to advantage, and the material collected in this way can be used for lessons in drawing.

The children can learn the varieties of apples grown in their locality and which are most successful for home use and for market. They can learn to distinguish some of the common varieties of other fruits. They can learn to know the nuts of the countryside and a little encouragement will result in a very good collection.

The pumpkin will serve for many lessons, and late on the afternoon of All Hallowe'en the older children can take part in making jack-o-lanterns and in having the candle lit before school closes. The child touch in connection with the real lessons is well worth the while.

23. Wild Flowers. Probably teachers are more familiar with the common wild flowers than with any other form of plant life. It will be well, however, to follow the personal notebook idea in regard to this subject, as well as in the work with trees and weeds. Each year there will be increased knowledge of the wild flora of the neighborhood, and the children never tire of this subject. In the schoolroom lessons, there will often be opportunity for teaching the boys and girls to be careful not to exterminate the wild flowers. In gathering flowers they should be taught that a few with leaves are more attractive than a great mass.

The kinships of plants are very interesting, and children should begin quite young to know that plants are classified into groups based on similar characteristics. The relationships can be brought out incidentally if the teacher has botanical knowledge. If on the nature study table there are plants that are akin, the children might be told in a simple way that some plants quite unlike in general appearance are related to each other. Who would think that the buttercup, anemone, hepatica, columbine, and peony belong to the same family? How carefully wise men must have studied to find this out!

If possible, there should be at least one trip to the woods in the spring time. This is the place to teach respect for wild flowers, the way to gather them, the soils in which they thrive, and the community life of the wood.

IV. ANIMAL LIFE

24. Important to Understand Animals. The importance of animal study in the lower grades can not be overestimated. Much of the child's development in observation, in sympathy, in tenderness, in power to love and serve, in character, in fact,

depends on this work. Pets are essential factors in child life. If boys and girls are taught responsibility in their relation to their pets, one fundamental essential for life will be established. Many will earn their living with the help of animals, and their success will depend on their understanding and observation of animal potentiality. The subject is full of educational possibilities.

In the lower grades, even in the third grade, let the emphasis in study be based on habits, food, and care. The anatomical study may come later. Almost all children know the facts that are brought out in outlines in many works on elementary nature study, such as observations of the eyes, the ears, feet, length of tail, use of covering, and the like, and they do not have spontaneous interest in these things. What does interest them is the way the animal lives and acts: the organized life of the ants; the apparent cleverness of the spider; the skill of the nest builder; the activity of the hen; the work of the beaver; the audacity of the crow; the faithfulness of the dog; the many uses of a cow; the possibility of companionship in a horse.

The terrarium (page 11) should be the center of the indoor animal study. The cricket cage or other simple device for separating the animals will be valuable. Teach absolute cleanliness and care in connection with the cages. This is vital to success. A few considerations of animal study that have been of interest in the lower grades in many schools are presented in these pages, together with suggestions for interesting boys and girls in them. Teachers may prefer to substitute other forms of animal life instead of those given here.

25. Facts for Schoolroom Work. We shall not give in these pages descriptive material that can be found in almost any good work on zoölogy. If a teacher has not enough interest in the subject to look up important facts regarding the animals, it would probably be as well to let the subject alone. In discussing the teaching of the forms of animal life, we shall try to present in brief some ideas that should be in the

teacher's mind in this work and some lines of thought that can not be looked up in a reference book. The most valuable text a teacher can have is one which she will herself prepare. As before suggested, a notebook should be kept in which each year will be gathered information learned first hand from natural objects, to which facts obtained by referring to encyclopedias and the many excellent nature works now in print are added. Such a work will count in the personal growth of the teacher and also make the best foundation for nature study lessons.

26. Birds. Thousands of persons even at the present day to whom birds make contribution in income as well as in other ways, have but little appreciation of their service. Others who have learned something of the economic importance of birds still believe that much that is said in their favor is due to the enthusiasm of bird lovers. All who are in doubt along this line should send for information to the government Department of Agriculture. Scientific facts can not be disputed, and from investigations by competent ornithologists all over the country many thinking people believe that no small part of national welfare has to do with its bird life. Wrong teaching of the past must be overcome by right teaching at present. Every one should lend a hand in this work, and the teacher can do most of all.

Merely telling the boys that they must not take birds' eggs or destroy bird life has but little influence. Children at a very early age must be put in sympathy with birds. They must learn the joy of the quest to see a new bird or to hear a new bird song. They must learn the real importance of birds in every community, city and country. The teacher should bear in mind that the truth must be taught. No sentimental attitude should interfere with this. If, in any community, the farmers believe that some birds are doing more harm than good, the children should be encouraged to make an honest investigation.

Bird study with young children should be based on an intimacy with habits, home making, food and haunts. A fun-

damental fact to teach is that the migration of birds has to do with food, not, as many believe, with the weather. Can nothing be done to make it possible for more of our birds to remain with us in winter?

The teacher should have knowledge of the economic importance of birds. She should have knowledge of some ways in which children can be taught to attract and protect them. She must do her part to overcome the prejudice toward some birds that has influenced boys and girls for generations. The three brief articles following, written by Dr. A. A. Allen[1], will give both information and suggestion: The first, *Food of Birds;* the second, *Nesting Boxes*, and the third, *The Crow.* The article on the crow should be read to the children. This bird is much abused in all farm communities, yet he has value. The fact that the crow, in the majority of cases, is not so bad as he seems may lead to investigation of other birds that have not a good reputation among farmers:

The Food of Birds

The various phases of bird study are many and diverting: the mysterious migrations, the bright plumages, the charming songs, the nests and eggs. It is seldom we succeed in tearing ourselves away from these and concentrating our thoughts on the more serious consideration of the bird's place in nature and the economy of bird life. When we do come to a realization of the valuable part the birds play in our own lives, we are inspired to even greater interest to learn all we can about them, to care for them, and to protect them. So immediate are their services, even so near to our purse strings, that we wonder how a true realization of their value could have been so long overlooked. It seems impossible that but a few years ago, a great many of our most beneficial birds were actually considered enemies to our agricultural interests and a bounty was placed on their heads. Such was the price of ignorance. Thousands of valuable

[1] Assistant Professor of Zoology, Cornell University, Ithaca, N.Y.

birds were killed before the harm that was being done was realized. And then it was too late! Scourges of insects and rodents swept over the country, causing losses of millions of dollars.

Let us consider for a moment the position allowed the birds in this country. Before its discovery and settlement and civilization by the white man, when nature was allowed to take her own course and settle her own difficulties, insect plagues of any kind were probably of very rare occurrence. The insects which to-day in countless hordes annually damage the crops to the extent of millions of dollars were kept down to normal numbers by their natural enemies, chief among which were the birds. If at any place there was an undue increase of insects, it meant to the birds more food easily secured and they flocked to the spot; and soon the insects disappeared. There always existed this "balance of nature." An increase in the abundance of any plant meant an increase in the number of insects feeding upon that plant, and a corresponding increase in the birds feeding upon these insects. Were we to follow it still further, we should find also an increase in the number of hawks and predaceous animals feeding upon the birds; for in every locality every species of animal, if undisturbed, tends to increase to the limit of its food supply.

Then the white man came to this country, cutting down the forests, planting grain, introducing new plants, and disturbing the balance of nature generally. Large fields of corn and wheat meant increased food supply for locusts, wireworms, cutworms, and the like, which formerly, between death by the birds and starvation, had been living a precarious existence. Naturally there followed a great increase in their numbers. Discovering this, the birds soon flocked to these fields where they found such an abundance of insect food. The settlers, ignorant of the habits of these birds and thinking they had come solely to feed upon the grain, did their utmost to kill them off and frighten them away. Without the birds to check them, such an increase of these pests

occurred that in places the settlers were forced for a time almost to give up the cultivation of grain. Forbush says: "In 1749, after a great destruction among the crows and blackbirds for a reward of threepence per dozen, the Northern states experienced a complete loss of their grass and grain crops. The colonists were obliged to import hay from England to feed their cattle." Again, "The greatest losses from the ravages of the Rocky Mountain locust were coincident with or followed soon after the destruction by the people of countless thousands of blackbirds, prairie chickens, quail, upland plover, curlew, and other birds." Similar ravages by insects following the destruction of birds have been noticed all over the world for centuries.

When the balance of nature has once been disturbed, it is always difficult to restore it. Since our agricultural progress means increased and increasing food supply for the insect pests, we must expect a corresponding increase in their number, and if we would harvest all of the yield we must provide a means for keeping them in check. Natural means have seemed insufficient; so we have invented artificial methods for their destruction. We poison our seed, we spray poison on the leaves and branches, we fumigate whole orchards, we even gather the insects by hand, spending millions and millions of dollars annually and yet without avail. Locusts destroy our wheat, wireworms destroy our corn, caterpillars destroy our trees and rob us of our fruit in spite of all we can do; yet in all this work of protection, we tend to overlook our most valuable allies, the birds. So quietly their work goes on, that many people live and die without appreciating anything but their beautiful feathers. True, at times, so striking has been the protection given by the birds that even the dullest could not overlook it. In 1848, after the first year's crops had been entirely destroyed in Utah by the myriads of crickets which came down from the mountains, and the second year's crops were rapidly disappearing, the settlers were saved from actual starvation by the thousands of gulls that descended upon the fields and

devoured the crickets. It was looked upon as a heaven-sent miracle; as a matter of fact, many such instances could be cited. It was but the same process which is going on about us every day of the year and which we do not realize until for some reason it is checked and we are overwhelmed with insects.

Nor is it from insects alone that our crops have suffered and again been protected by the birds. Among new plants introduced into this country, some were brought in, through either mistake or ignorance, that soon got beyond the control of the colonists. Finding conditions here so much more favorable to their growth than in the old country, they spread rapidly, soon became obnoxious, and to-day are known as weeds. But rapidly as these have spread and become a menace to our agriculture, it is not a circumstance to what would have happened or still would happen were we to drive away the birds. Think of the hundreds or even thousands of seeds produced by each plant. What would happen if all were to grow and reproduce themselves? But as long as we have the birds we need feel little danger. All our sparrows together with many other birds are primarily seed eaters, and many live almost altogether on the seeds of weeds. From the stomach of a single bob-white Dr. Judd took five thousand seeds of pigeon grass. If this represented a single meal of one bird, we can readily understand why our weeds are no worse than they are.

The hawks and owls have perhaps been persecuted most of any of our native birds because of their occasional visits to the poultry yard; yet were it not for these birds we should be so overrun with mice and other small mammals that life would be unendurable. History is full of accounts of mouse plagues which have finally been conquered by large flights of owls. In certain parts of New England to-day, in large part owing to the scarcity of hawks and owls, field mice have become so abundant that young fruit trees can not be grown unless protected from them by artificial means. In sections of the West, partly because of the destruction of hawks and

owls, jack rabbits and gophers have become so abundant that organized efforts have to be made to destroy them. In Pennsylvania some years ago the thousands of dollars paid for bounties on the heads of hawks and owls was but a trifle as compared to the cost of the ravages of the rodents following their destruction. It is only in comparatively recent years that we have come to realize that birds are our friends. True, in our introduction of poultry, we have greatly increased the available food supply of certain of the birds of prey, and it is natural that they should take advantage of it. The toll they levy upon our poultry yards, however, is but little compared with their value in keeping down the number of weasels and small rodents.

Laying aside then all aesthetic reasons, which in themselves are sufficient, we ought to protect all of our birds, not only for their indirect but for their immediate influence on our personal welfare. This is true not only for the farmers, but also for those living in the villages and cities. Wherever there are trees or gardens to be protected from insects and weeds, the birds are our best friends. Books have been written, filled with certified instances of birds having prevented invasions of aphids, caterpillars, potato beetles, cutworms, white grubs, and pests innumerable.

But enough has been said to convince us of the actual value of the birds. Now what are we to do? What is the legacy which previous generations have left us? In the first place, we must counteract what has been done in past years in frightening away the birds. We must call them back to haunts from which they have long since been driven and do what we can to overcome the fear which has been instilled into them. It is true that wild birds respond to kindness, and where dangers have been removed some of the most timid have been found to become as tame as domestic fowls. When their sense of fear has been allayed, they will flock to our habitations to destroy insect invasions even as they now flock to similar invasions in the wilds. But it means a long, hard fight to overcome the dreadful work of so many

years. The coming generations must be educated to the knowledge that birds have a better use than as targets for sling-shot and gun, that they are more valuable than meat in the pot-pie or decoration for women's hats; that especially about our homes should they be encouraged and protected; that a bit of suet in the tree or some seeds on the snow may mean a troupe of watchful little guards about our orchard all winter; that the removal of a few stray cats and the proper care of our pets is our just duty; that a few bird houses about the house and garden for bluebirds and wrens will do more to keep down the insects than many a gardener; that wood lots and thickets about the farm are as necessary as high fences; that bushes and trees about the house and garden for the protection of the birds are as necessary as laws; that the planting of wild fruit for the birds will save our cultivated trees. These and many other things must be taught to the coming generation.

Suggestions. 1. In the study of birds in the schoolroom, special emphasis should be laid upon their practical, every-day value to the farmer, fruit grower, nurseryman, and to people in general. Children should be encouraged to watch birds feeding, both caged and in the wild state. If at any time one is fortunate enough to have a young crow or other bird in the schoolroom, accurate observations should be encouraged as to the exact amount and nature of the food eaten. Such observations on a young robin have shown that it occasionally eats one and five-sixths its own weight of food in a single day. It averaged 50 to 70 cutworms and earthworms a day and one day consumed 165 cutworms. Even when full grown it required one-third of its weight of beef each day. Similar observations on a young crow showed that it required food equal to one-half its weight daily. One day when it was fed two ounces of tomato, 56 grasshoppers, 12 crickets, and a little grain, it lost 10 per cent in weight. From this, it can be understood how destructive to an invasion of grasshoppers a flock of crows would be, if they gorged themselves.

2. Children should be encouraged to watch birds feeding out-of-doors with the interest to discover the nature of their food. Oftentimes a robin will nest in a convenient place where one can watch the number of times the parents bring food and very often determine the exact nature of the food. If birds are seen feeding upon seeds, an attempt should be made to determine whether they are the seeds of obnoxious weeds.

3. Bird houses constructed by the children should be placed on the schoolhouse or about the grounds, where the feeding of the young can be watched. The children can soon learn to approach the bird houses without alarming the tiny tenants.

4. The planting of mulberry, mountain ash, virginia creeper, or wild fruit trees about the school grounds should be advised in order to attract the birds.

5. Children should be encouraged to feed the birds in winter by fastening suet in the trees and scattering seed in a definite place on the snow. A birds' "Christmas tree" and feeding shelf should be established near a window or where it can be observed from a window. This will be most satisfactory if there is a tree close at hand by which the birds can approach. The shelf should be erected in a convenient place and some sort of branch or small tree fastened to it. A pile of brush near by for shelter would also avail much. Suet should be tied to the branch and seeds sprinkled on the shelf. It will not be long before there are frequent visitors.

6. The boys should always be encouraged to lay aside the sling-shot and gun and take up the use of notebooks and field glass.

7. Children should be taught the necessity for the proper care of cats, for stray or ill-fed cats are the greatest enemies our birds have to fear. John Burroughs says that cats probably destroy more birds than all other animals combined. It has been estimated that in Massachusetts alone, a minimum of seven hundred thousand birds are killed annually by cats.

Nesting Boxes

There are many ways of attracting birds to the home or to the schoolhouse, some of which have already been presented to you. We may hang suet in the trees and scatter seeds to attract the winter birds; we may provide food for our summer visitors in case of want and establish drinking fountains and washbasins. But one of the most successful and interesting means at our disposal for attracting the birds is that of building nesting boxes.

Perhaps we have been feeding the winter birds with such success that the chickadees and nuthatches and woodpeckers have ever been with us and we wish to keep some of them all through the spring and summer, or perhaps we wish to attract other summer birds as they come back to us in the spring. The cheery bluebirds, the industrious wrens, and the graceful tree swallows may be invited to remain about our dwellings by the proper placing of nesting boxes, and if they chance to select our proffered box for their chosen home we may feel well repaid; not only by the beauty and interest that they will bring into our lives, but because in feeding their hungry young they will protect our trees and gardens against the ravages of insects. Having decided to put up one or more nesting boxes, the question naturally arises, what kind of a box to get and where to place it. The object of this article is to put such information at your disposal in the simplest form.

In the first place, many birds that can be attracted in no other way will be attracted by the planting of trees and bushes. We must not expect them to come to our boxes. Other birds will nest about our buildings, if they are given any encouragement in the way of a protected shelf on which to place their nests. These are the robins, phoebes, barn swallows, and eave swallows. The modern barn, with its vermin-proof walls and smooth rafters, provides neither entrance for the swallows nor places for them to attach their nests. The painted boards beneath the eaves are too slippery for the gourd-shaped nests of the eave swallows. The man

who builds a barn little realizes that he is driving away one of the chief protectors of his crops. He should make haste to cut an opening beneath the gable and to nail cleats to the rafters and beneath the eaves, that he may once more avail himself of the services of the swallows. Similarly, cleats or shelves placed about the porch, above the pillars, or in other sheltered corners will provide nesting places for the robins and phoebes and will encourage them to remain with us. These shelves should be placed less than a foot apart beneath some projecting roof or other shelter.

The buildings of our forefathers were full of nooks and crannies where wrens and bluebirds liked to nest; the orchards were not so scrupulously pruned, and woodpeckers found plenty of dead limbs in which to drill their holes. To-day we must provide artificial nesting sites to take the place of these natural ones, if we wish to have the birds about us as they used to be.

Some birds, notably wrens and bluebirds, will avail themselves of anything in the way of a shelter which you see fit to put up; while others, such as woodpeckers and nuthatches, are more particular and require something more natural in the form of a hollow limb. The chief difficulty will not be in the construction of the boxes or in attracting the birds, but in keeping out the English sparrows. These interlopers are ever present and ready to begin building as soon as the box is in place. Needless to say, you do not wish these rascals, but prefer our native birds. There is no sure way of keeping them out except by hanging the box on wires so that it swings freely in the wind. The objection to this box is that it proves less inviting to our native birds, and so should be attempted only as a last resort. One meets with greatest success with boxes placed on exposed holes or in trees, with the opening no larger than is necessary for our native birds: one and a half inch for swallows and bluebirds, smaller for wrens and chickadees.

The Box. No money need be expended on this. Old, weather-beaten timber is more attractive to the birds than

smooth, painted boards. The best boxes will be made from sections of a hollow limb, covered above and below by weathered boards with a hole drilled near the top of one side. Artificial limbs can be made from bark or by hollowing out solid branches with the bark still attached. Old boxes, or new ones made for the purpose, are next best. For the smaller birds, such as chickadees, wrens, bluebirds, and tree swallows, the boxes should measure not more than 12x5x6 inches, and they may be considerably smaller to advantage. The ordinary crayon box of the schoolroom is very serviceable, but requires reinforcing with wire or nails so as to withstand the weather. Cigar boxes and codfish boxes are generally less satisfactory than odorless ones, and all bright surfaces should be avoided. A box with the top or one side hinged is better for observation, but care should be used to keep it permanently fastened.

Old teakettles, tin funnels, and cans of various sorts have been used by some persons with success, but the box is more sightly and usually more attractive to the birds. The opening should be made circular or square, preferably the former, and toward the top of one side. It should be not larger than the dimensions given above.

If one is not bothered with sparrows, a perch should be provided beneath the opening; but inasmuch as sparrows do not take so readily to boxes without perches as do other birds, it can be removed if necessary. A perch should be placed in the near vicinity, however, on which the birds may alight before proceeding to the nest.

A layer of sawdust may be placed in the bottom of the box, but the use of other nesting material is to be avoided. For chickadees and swallows, however, cotton or feathers scattered near may prove attractive if there is no poultry to furnish a supply.

Placing the Box. Inasmuch as the birds prefer weather-worn materials to bright surfaces, it is well to have the box in position by early spring and thereafter left from year to year. In placing it, three things should be borne in mind:

attractiveness to the birds, comfort, and protection. For the swallows that prefer the open, the box should be raised on a slender pole several feet above the fence, clothes pole, or outhouse to which it is attached. The pole should be strong enough to prevent it from swaying in the breeze, and yet sufficiently slender to protect against marauding cats. Sometimes, if squirrels are abundant, it is necessary to place a metal shield about the pole in order to prevent them from climbing to the nest for the eggs or the young. The pole should be near a building, dead tree, telephone wires, or other natural perch. Wrens and bluebirds also may frequent this box, but they prefer to have a tree in the immediate vicinity. Boxes placed seven to twenty feet up in a tree generally prove more attractive to the latter birds, as well as to the chickadees and nuthatches; but care should be used to guard the tree from cats by shield of metal or wire netting. As exposed a position as possible should be chosen for the site, yet one which is more or less shaded from the sun during the heat of the day. It is better to have the box face toward the south.

Frequently, boxes placed on the house or the school building, below or beside an upper window, prove attractive to wrens, swallows, or bluebirds and are then near enough for observation. These boxes, however, are frequently overrun with English sparrows, and are unsuccessful for that reason.

The best results with bird boxes are always obtained by studying the habits of the birds of the neighborhood that nest in holes, and by reproducing such conditions as nearly as possible.

The Crow

The crow came in with civilization. Although practically unknown while the country was covered with dense woods, he has now become one of our most abundant and best known birds. Sociable in his nature, omnivorous in his feeding habits, sagacious in his actions, he is eminently fitted to replace the solitary raven which left us with the forests.

In no place is he more at home than in the farming districts. Here he finds the open country in which to feed, as well as timber sufficient to shelter his nest. He usually escapes his few enemies. It is seldom he falls a victim to a hungry hawk or starving owl and he avoids even more successfully the man with a gun.

IN SOME PLACES HELPFUL

The crow is generally considered a thief and a scoundrel and his better side overlooked entirely. He robs the nests of smaller birds, devours a great deal of grain, and in his zeal for hunting cutworms and grubs uproots enough young corn to blacken his name with any farmer. Seldom is his aid in destroying insect pests and vermin appreciated, although these, if allowed to go unchecked, would do much more damage in many places than the crow himself!

The chief fault of a crow lies in the fact that he is lazy. An omnivorous feeder, he takes whatever comes most easily; locusts, cutworms, white grubs, mice, frogs, fish, young birds or grain. Whatever is most abundant and most easily secured forms his diet. In this way he becomes of great assistance in checking the larger of our insect foes, for any excessive increase in their numbers means to him simply "easy food," and he feeds entirely upon them until their numbers are reduced and something else is more easily obtained. It is only when other food is scarce that he does much damage to grain or young birds. Therefore, if we can protect our grain without destroying the crow, we shall be doing a service both to mankind and to nature.

"My friend and neighbor through the year,
Self-appointed overseer

Of my crops of fruit and grain,
Of my woods and furrowed plain,

Claim thy tithings right and left,
I shall never call it theft." —JOHN BURROUGHS.

How to Teach Birds to Primary Children. Everything in relation to the teaching of birds must be done with spirit. Little children will never get education from a robin by following an outline. They must follow the robin himself and each year deepen their love of him, their need of him, and their knowledge of his interesting life and ways. Before the teacher can help the children in the best way, something of the following must be in her mind and heart:

THE ROBIN

BY L. H. BAILEY

"The drifts along the fences are settling. The brooks are brimming full. The open fields are bare. A warm knoll here and there is tinged with green. A smell of earth is in the air. A shadow darts through the apple tree; it is the robin!

"Robin! You and I were lovers when yet my years were few. We roamed the fields and hills together. We explored the brook that ran up into the great dark woods and away over the edge of the world. We knew the old squirrel who lived in the maple tree. We heard the first frog peep. We knew the minnows that lay under the mossy log. We knew how the cowslips bloomed in the lushy swale. We heard the first roll of thunder in the liquid April sky.

"Robin! The fields are yonder! You are my better self. I care not for the birds of paradise; for whether here or there, I shall listen for your carol in the apple tree."

Birds That Tell Their Names. Children in primary grades will become very much interested in the birds that tell their names: the chickadee, the phoebe, the pewee, the whip-poor-will, the bob-white, the bobolink, and others; and also in the birds that speak in a way that identifies them, such as the owl and the catbird. If in preparing to discuss these birds with the children the teacher will have a few facts regarding them, as to size, color, and the like, the children will be on the lookout for them. Following is a suggestive list:

Painted by L. A. Fuertes. Engraved exclusively for Public School Methods

THE ROBIN

Chickadee	Owl
Woodpecker	Whip-poor-will
Meadow Lark	Bob-white
Song Sparrow	Crow
Catbird	Phoebe

STUDY OF THE HEN. All young children should be interested in the robin, bluebird, and English sparrow. They should also know quite intimately the birds in the poultry yard. The structural feature of birds need not be discussed to any great extent in the lower grades. Some study along this line, however, may be valuable, and a hen will be useful for this purpose. This will lead to some fundamental study of poultry, which is always worth while.

Have the children note how the feathers of the hen overlap each other as shingles on a roof. They make a good raincoat. It is interesting to watch a hen when it showers. She stands so that the water falls off her back. Is there any difference between the feathers on a hen's back and those on her breast? Who has seen a hen oil her feathers? She has a little oil sack near the base of the tail for the supply of oil.

In studying feathers, the children will take an interest in noting that birds have feathers for use and feathers for ornament; that the mother birds are not so gayly clothed as are the father birds; and that this is a wise provision, because the mothers take care of the nests and in plain dress are not so readily seen by enemies. They will notice how ornamental is a rooster's tail and the coloring of his neck, the attractive coloring of a drake's head and wings, the tail of the turkey and the peacock. Attention may be called to the ornamental features of combs and wattles of poultry.

In noting some of the simple structural features of the hen, the children will themselves think about the location of the hen's eye. She looks at us first with one eye and then with the other. They will also be able to compare her beak with the beak of a duck; and find the difference between the feet of the hen, a scratcher, and the feet of the duck, a wader. They

will notice the scales on the feet of the hen; they will have seen scales, perhaps, on fishes, on a little snake, if one is brought into the school, and on the turtle.

The way a bird flies can be discussed; how pushing the air down with the wings enables them to fly and how the tail is used as a rudder. The children should consider whether the domestic birds need to fly in getting food and for protection as much as the wild birds do. Such simple observations are full of interest and educational value when studied in connection with a real bird.

It will be very easy in almost any community to have not only a live hen and a live duck in the schoolroom during the term, but also a pigeon and a canary. The children will grow very much attached to the pigeon, and it will become a real part of their lives. They will also derive profit and pleasure from a canary. Although to a lover of nature a canary does not give much joy, it can be used to advantage in the study of birds and is a form of bird life that the teacher in the city can borrow for a few lessons.

Occasionally a pet crow can be brought to school as a visitor. He will always be welcome, and if somewhat noisy, the children will do their part in concentration on other work for the sake of having the crow in the schoolroom.

Note. One of the most valuable lessons in connection with bird study is to teach the boys that many bird songs are whistles which they can learn to imitate. Some ornithologists have made a study of bird notes and a few can imitate them; in fact, this is sometimes done most skillfully. The listener can close his eyes and imagine himself in a wood still wintry in which can be heard the phoebe call of the chickadee; or he can recall the afternoon of a summer day out along a wooded stream that is gladdened by the mystic song of the veery; or again feel himself in the night wood through which the little screech owl sends his strange, weird cry.

27. Fishes. Many persons never realize the wonder of the fishes in our lakes and streams. They, perhaps, have

caught fishes and eaten them but have not known much of the beauty of form and color nor how remarkable is the adaptation of their structure to the water world.

Every child should have an opportunity to watch a fish and he should be directed in simple ways in his observations of it. A battery jar or any large glass vessel will provide a place for this. If one fish at a time is studied, it is not difficult to keep it comfortable. If the fish loses vitality, the children should be instructed to take it back to the pond or stream from which it came.

The fish for study should be taken from the water in a net and not handled. The water in which it is kept in the schoolroom should be changed when needed and occasionally aerated. The jar should not be left in the sun. A very small amount of fish food should be given every other day. If the teacher understands how to make and keep a balanced aquarium, it will, of course, provide better study than to have one fish in clear water. Consult the chapter on aquaria in *Nature Study and Life*, by Professor Hodge.

In case the school is not near any pond or stream, a gold fish will give children the opportunity of watching a fish and of trying to understand what they see. If waterways are near, Johnny darters, minnows, sunfish, sticklebacks, or other small fishes can probably be secured. A bullhead is hardy and although his way of life is to seek the muddy places, one lived for many weeks in clear water in an aquarium jar in a schoolroom. He was a joy to the children and although he was a much-prized pet, the class finally voted to take him back to his natural haunts. The leave-taking of Billy, the bullhead, was very interesting.

In the observation of fishes by young children it would be well to direct their attention to the following:

(a) The shape of the fish, which enables it to go through the water.

(b) The location of the fins.

(c) What part of the fish is used as propeller?

(d) How does a fish steer itself?

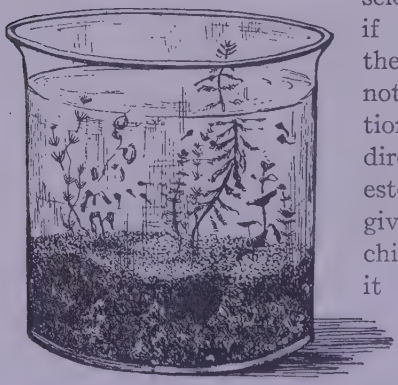
(e) Has it eyelids?

(f) Do all fishes have scales? What about a bullhead?

(g) Watch how a fish breathes. See him open his mouth, take in the water, force it over the gills and out through the gill openings. A fish must get the air from water.

(h) Some fishes make nests. Has any boy or girl ever seen the nest of a sunfish ("pumpkin seed") with a father fish guarding it? The nests are merely depressions on the bottom of the stream. Many persons have seen this.

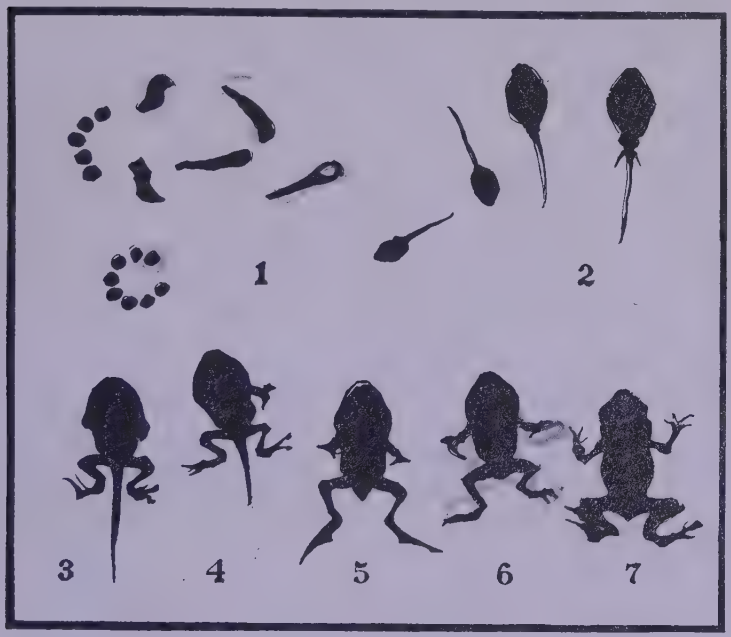
28. Amphibians. (TOADS, FROGS, SALAMANDERS, ETC.) A fairly well organized grouping of animals will be unconsciously learned by the children if the teachers in preparing the lessons have this in mind; not that there is any objection to presenting the groups directly if the teacher is interested in doing this, nor in giving scientific names to young children if circumstances make it possible and desirable, but such teaching is not essential. In the study of amphibians the teacher will be able to connect observation on the animals of this group: toads, frogs, salamanders and other forms. The most satisfactory of the amphibians for the children to study in the schoolroom are the toads and salamanders. Let no teacher lose the opportunity to educate by means of these animals.



A TADPOLE AQUARIUM

Place a deep earthen jar in the schoolroom, and put in some mud and plants from the bottom of a pool of stagnant water; then fill the jar with water, pouring it in very carefully so as not to disturb the mud and plants. After the mud has settled and the water has become clear, place some toad's eggs in the jar. Have the pupils watch them hatching and the development of the tadpoles. Toads' eggs are laid in strings

of jelly in ponds, and can be scraped from the bottom with a scoop net. The pupils should be taught to care for the aquarium and see that it is supplied with water from time to time. The teacher cannot direct the pupils in these observations, however, unless she has become familiar with them.



DEVELOPMENT OF THE TOAD

1. Eggs and young tadpoles. 2. Full-grown tadpoles. 3-7. Successive changes from the tadpole to the toad

Lead the pupils to see how valuable the toad is in our gardens and how industrious and skilful he is in his pursuit of insects. Let them discover his ability to remain motionless while he looks like a clod of earth as he waits the approach of the unsuspecting insect. Encourage the children to look for toads in the garden and notice where they usually find them. Toads are very valuable on farms and in gardens, and boys and girls can help to take care of them.

The salamanders are even more interesting than the teads. Children grow attached to them on short acquain-

tance, and many college students have found them very companionable pets. The children will often call a salamander a lizard. This will give the teacher an opportunity to tell them that the lizards belong with the snakes and turtles—that they have scales which the salamanders have not, and differ in other ways. Some teachers will have an opportunity to teach first hand the differences between lizards and salamanders.

If teachers have never seen a salamander, ask the children to look under stones or along the brook sides for a little creature that looks something like a lizard but has no scales on its body. They may bring the spotted salamander, black with orange spots, or the land form of the spotted newt, red with vermilion spots along the sides; or in scooping things out of the pond they may find the water form of the spotted newt. Many children have found the little slimy salamander, a black one with bluish-white specks. Let us consider a few of the species and be ready to recognize them if they come our way:

(a) The Spotted Newt. This salamander deceived many naturalists for a long time. They were well acquainted, as they supposed, with two distinct species: the one, greenish in color, with vermillion spots along the sides, which lives among the water-folk; the other, red, having the same arrangement of scarlet spots, that lives on land. It was finally discovered that they are one and the same, appearing in different colors as they change their dwelling place.

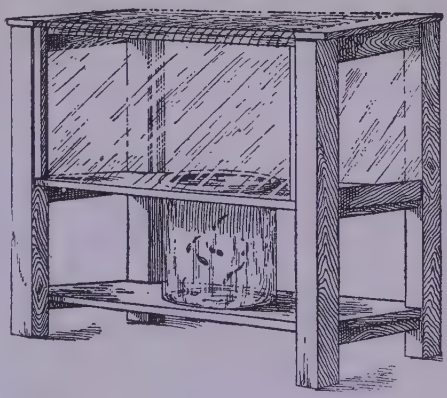
The spotted newt leads a strange life its history being divided into three periods after it is hatched from the egg. First, dressed in green, it lives in the water, matching so well the background of slime and plants that enemies have difficulty in finding it. The next stage is spent on land, where it wears a reddish coat. This is not conspicuous in the woodland and wayside spots which it haunts. The third and last period is aquatic. Clothed once more in green, it again takes up its abode among the water-folk, unchanged in habit and found during the day under boards and stones.

(b) THE LARGE SPOTTED SALAMANDER. This species is black, with orange spots on each side of the back. It is found in marshy places.

(c) RED-BACKED SALAMANDER. The red-backed salamander is known by the broad reddish band on its back. The body is slender. It is found in woods and on hillsides.

(d) THE DUSKY SALAMANDER. This salamander, blackish in appearance, will be found in moist places.

(e) THE SLIMY SALAMANDER. This form is black, usually with bluish-white blotches and specks, often found under stones.



INDOOR QUARTERS FOR SALAMANDERS

In the accompanying illustration is presented an arrangement for indoor quarters for salamanders. The upper part should be enclosed by means of netting so that the salamanders can not escape. Cover the platform with two layers of moss. Between the layers of moss place, from time to time, pieces of wood from a decayed stump. In this wood the salamanders will get food to their liking. It will probably contain insects and their eggs, worms, etc. Salamanders have been taught to eat raw meat by moving it in front of their eyes, but it is better to let them find their food in the decayed wood or have the children gather small worms for them. They will feed on meal worms.

If the study of toads and salamanders proves satisfactory, the teacher will enjoy preparing material on frogs and tree frogs.

29. Reptiles. (SNAKES, TURTLES, ETC.) Snakes are interesting, and if a teacher has knowledge of them and no decided prejudice against them, it may be satisfactory to have one

in school. The objection to them is often so strong on the part of parents and children that teachers may prefer to substitute other forms of life.

Among the reptiles, the turtle will be found most interesting for study and should not be neglected. Never was wild creature a greater pet than "Solomon," a box turtle used for lessons in a primary grade; unless, perhaps, a class of long ago will take the stand that "Dewey," a painted turtle, was as much a favorite. Turtles are remarkable in structure. They are safe pets and easy to care for. The little children love them and enjoy experimenting in finding food for them. The teacher can help in this by discussing the natural habitat of the turtle visitor and the kinds of food likely to be found there. Solomon, the land turtle, did not eat for many weeks and then partook of a banana as if at last his favorite dish were served.

If we want to keep turtles indoors and make them comfortable, we must imitate the surroundings of their natural home. There should be both land and water areas. Quite as essential to turtle comfort as these is the opportunity for concealment. The clumsy creatures cannot get away from their enemies quickly and must, therefore, be able to hide from them. Some turtles will be comfortable in the terrarium, but good turtle quarters may be made as follows:

Take a good-sized soapbox and cut a hole in the bottom in which a milk pan can be lowered. Under each side of the box place a block of wood as deep as the pan. This arrangement will give opportunity for the land and water conditions; placing a slanting board above the land area, and a handful of duck weed or some other plant in the water, will give the turtles a feeling of safety. Make the cage as neat and attractive as possible. Paint it dark green.

In the study of turtles bear in mind the following:

(a) Is the turtle a land turtle, a water turtle, or a mud turtle?

(b) The box turtle can get completely inside its shell. The snapping turtle is not so well protected. On intimate

acquaintance we find that Nature has given the snapping turtle another means of defense. What is it?

(c) As we come to know turtles out-of-doors we shall see that they are protected by their coloring. The old wood tortoise resembles the dusky way along which it travels. The mud turtle is the color of the mud. The painted turtle, although brightly colored, usually sticks only its striped head, which imitates the plants, above the water. Notice the way in which coloring protects other animal life.

(d) If we are patient, some turtles will become tame enough to eat raw meat from our fingers. They seem to find a bit of bologna sausage irresistible. Do not feel anxious if they refuse food for several weeks or even months.

(e) Turtles bury their eggs in the sand a few inches below the surface, where the heat is most uniform.

(f) What enemies do turtles have?

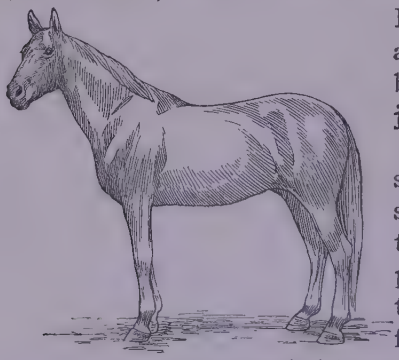
30. Mammals. From the very beginning, children should be taught appreciation of animals of economic importance, and such teaching in the lower grades should develop love of these animals and interest in their habits, food and care.

When one stops to realize the part the horse, cow, sheep and other animals have taken in human lives, how the appreciation deepens; we wonder that there has been so much carelessness and cruelty practiced in connection with them. This thought is not born of sentimentality, but fact, and education is needed to bring about better domestic animals and better owners than many in the past have been. Considerations of the suggestions here given will help teachers in the study of animals that children know.

(a) The Horse. Boys and girls see horses daily. In the country there are the farm horses, the doctor's horse, the postman's horse; in the cities the children see the horse of the butcher and the baker; the horses that drag the heavy coal wagons up the hills; the saddle horses; and the horses trotting along the boulevards. One rarely sees a horse and a small boy any place near each other without noticing interest on the boy's face. The boy is looking at the horse. Can

he be taught to see what he looks at and, perhaps, to reason from what he sees? A few questions such as the following may be occasionally given:

(1) Where is the horse's knee joint? (The knee joint is situated a little over half way down the front leg between the fore arm, which is above, and the canon, which is below. It corresponds to the wrist of a man.) Which way does he bend his knee? (The knee joint bends backward.)



(2) Can a horse sleep while standing? (A horse can sleep standing, and will do so rather than lie in an uncomfortable place unless there is something the matter with his feet, or he is very tired.)

(3) Ask the boys and girls to notice how the legs are placed when a horse lies down. (When a horse lies down he draws the four feet together under the body, lowers the head, bends his knees, until they touch the ground, and gently falls over on the side, the right or the left. He may now assume one of two positions: first, if on the right side, he rests on the chest and abdomen with all four legs half bent and drawn up towards the abdomen, the head and neck swung to the left and probably resting on the limbs or against the abdomen; second, he may lie flat on his side with head, neck, body, and legs all stretched out on the ground.)

(4) How does a horse get up? (To rise, the horse raises the head and neck, extends the forelegs in front of him and raises himself part way up on them; in the meantime he has placed his hind feet on the ground a little removed from the abdomen; then by a quick effort he brings himself up on his feet.)

When a cow rises, she lowers her head and neck, rests her fore quarters on her knees, raises herself up on her hind feet, then by a quick effort rises to her fore feet.

(5) How does a horse start to walk? (A horse in starting to walk after standing, may start off with either his right or his left foot. In case he starts off with his left foot, almost at the same time he raises his right hind foot. As he walks, a horse moves on diagonal feet.)

A teacher should have knowledge of the breeds of horses.

The draft horse, with short legs; heavy body; short thick, neck; broad, deep, chest and shoulders, strong hocks; moderately large feet. These horses are used for heavy work.

Coach horses, with long, arched necks and fine heads; with rounded and well-proportioned bodies.

Roadsters, trotters and saddle horses are usually smaller than coach horses. Their necks are longer and their chests narrower.

It will be a good thing for the teacher to collect from time to time pictures of draft horses, coach horses, and other breeds, in order to show the children some differences that will help them in their observations of horses in the highways or on the farms. The children will, of course, be interested in the Shetland ponies, and in all ponies, and perhaps some day one of the children may bring his own into the school yard for a lesson. This would be to the little folk the best of all.

A few simple talks with the children as to the care of animals will be valuable in the lower grades. Teach them the ability many persons have had to understand horse language. Teach them how they can learn to know how a horse feels about many things by watching his ears; by understanding his whinny; by simple experiments in acts of kindness and affection. They should know how important are kind treatment, regular food, good care, and proper housing if one wishes to make a horse valuable. They should be taught the importance of having a stall in which a horse need not be tied; of having the stall well lighted; of having the air in it pure and dry; of giving the horse water to drink, and of having salt where he can help himself to it.

Many of the children have seen a trained horse perform. The person who is successful in teaching horses is the man who understands the horse.

The children who have horses at home will be interested in discussing some of the following:

(1) A cold bit should never be put into a horse's mouth. If very cold, it may take the skin off from the tongue.

(2) If horses are in the pasture, they can be taught to come to the owner if he will feed them something at that time that they like.

(3) Horses should be protected from flies.

(4) The harness should fit.

(5) The bit should be easy.

(6) The blinders should be carefully adjusted.

(7) A whip will not need to be used frequently, if it is used wisely and only when absolutely needed.

Some teachers are interested to know the proper food for horses, since this subject may come up in lessons on the horse. In this connection Professor M. W. Harper[1] gives the following:

"The foods given to a horse vary according to the locality. In the Northern States, Indian corn or oats constitute the grain part of the meal, while cornstalks or timothy hay constitute the coarse part of the fodder. In the South, Indian corn is the common grain, and dry cornstalks the coarse material. On the Pacific coast, barley is the grain, and wild oats, or the barley and wheat plants, the coarse material. Wheat-bran is also a very good food and should never be dispensed with in feeding the horse, especially the driving horse, which is likely not to be regularly driven. There is nothing better to feed a horse than good sound oats, Indian corn, and wheat-bran for the grain part of the meal; nor is there anything better than good sweet timothy, or mixed timothy and clover hay, free from dust, for the coarse part of the ration.

[1] Assistant Professor of Animal Husbandry, New York State College of Agriculture, Ithaca.

"The number of pounds to be fed per day can not be stated with exactness. That will depend on the kind of food, as well as the size of the horse and the kind of work he is called on to do. We may say that a horse of the average size doing light work will consume 20 pounds of dry matter, water free; one doing medium work, 24 pounds; and one at heavy work, 26 pounds per day of dry matter, of which one-half to two-thirds should be grain, the remainder coarse fodder. The proportion of grain that should be fed depends on the kind of work the animal is doing. When the horse is hard at work, the grain should be increased and the hay diminished; when he is idle, the hay should be increased, and the grain diminished.

"The portion of the day's allowance that should be fed at each meal can be stated with more exactness than the amount. The animal should be fed three times per day, having one-quarter of the day's allowance at least one hour before going to work in the morning. When the morning's task is over, he should be watered, then fed another quarter of his allowance, and watered again on the way to work. When the day's work is done, he should be watered, then fed the remainder of the food, which will be one-half of his day's allowance. The reason for the large meal at night is that he now has ample time to masticate and digest his food. He should be unharnessed at once, and when the sweat has dried, be given a thorough brushing. A horse cared for in this way will come from the stable full of vim and energy and ready to attempt any task he may be called on to do."

One Plan for Interesting Children in Observing Horses. In teaching the horse, emphasize its importance by making an event of one lesson. Tell the children that in a week or two, a part of Friday afternoon will be spent in talking about horses, and until then everybody will find out all they can about them. This work will, of course, be for the third grade. In the first and second grades some of the simplest ideas presented may be used.

Have as much room as possible on the nature study table for the lesson on the horse and collect things of interest in

relation to it. This is one subject for which some manufactured products will be helpful in giving instruction: Pictures of different kinds of horses for the scrap book; samples of feed neatly arranged on the table. Have the children find out at home what is used to feed horses and then let different children bring samples of the food. If possible, let one of the children take home a French glass bottle and get some flies that are found annoying the horses. Discuss means of protection from flies.

(b) THE COW. Since the cow is one of the most important domestic animals and has relation to the life of every child, the study of a cow and its products should be emphasized. Clear the nature study table as well as possible and have the children prepare for lessons on the cow. In the cities the real nature study lesson which will come from actual observations of the cow can not be worked out, but every child should know about cows and dairy products, and some of the suggestions here given can be made full of interest.

Have scrapbook pictures of the different breeds of cattle. These will be found in many farm periodicals. A good chart can be made from such pictures. Have samples of feed. If possible, borrow a modern milk pail and discuss why it is better than the old kind of pail. Many of the children have baby brothers or sisters; ask them why milk should be clean? Milk is the best kind of food, and the cow gives it to us. Why does a cow deserve the best kind of care? In this connection the teacher can from time to time bring out facts from the following on the care of the cow, made by Professor E. S. Savage.[1]

"All cows deserve better treatment than they receive. They are entitled to the best of treatment, for they give us

[1] Assistant Professor of Animal Husbandry, New York State College of Agriculture, Ithaca.

milk, butter, and cream while they live, and even when they die they give us shoes and robes to keep us warm. Beef, the meat that they yield, is an important article of food.

"A good cow is entitled to six things from her master: (1) Kindness; (2) a clean, dry home; (3) plenty of light; (4) pure air; (5) pure water; and (6) an abundance of salt. Every caretaker of cows should see that these conditions are met, as well as see that his cow has plenty to eat.

"Every animal in a well-managed dairy herd will be so tame that the owner and attendants can catch her easily in the open lot at any time. A dog, be he ever so gentle, is of little use in connection with a dairy herd. A club or a whip should have no place in a dairy barn.

"Light and ventilation explain themselves. We must supply all the light and the pure air possible. It is not costly to provide light in a stable, neither is it very costly to provide efficient means of ventilation in old stables if the owner is a live, hustling manager with his mind open to the best in his power for the comfort of his animals. All the dairy papers and experiment stations are ready at any time to help and suggest means of bettering stable conditions, with plans that may be had for the asking. Most of these plans are simple and economical, and farmers are fully capable of putting them into execution.

"Cows should be watered at least twice a day. The water should be pure, and, if possible, it should be free from ice at all times of the year. If cows have a place to drink where ice does not form, and if they are watered twice a day, it does not seem necessary to warm the water artificially. It is important to avoid chilling the animal; she should not have to stand and shiver after drinking. Any system is a "good watering system" which will furnish pure water and which works so that the cow gets all that she requires at least twice in twenty-four hours.

"A cow should be furnished with about one ounce of salt every day. The practice of our best dairymen varies. The writer would suggest feeding each cow about two ounces

of salt three times a week, either mixing it in the grain feed or merely throwing it into the manger any time during the day.

"If boys and girls in helping their fathers to take care of the cows, will keep in mind the foregoing they will be doing a service for many persons."

For the real nature study of the cow have children make simple observations, whenever possible, as follows:

Do all the cows in the neighborhood look alike? How do they differ? Whose cow gives the most milk? Let us try to find out. Everyone try to see Mr. ———'s cow before Monday and find out what color she is. Find as many colors on the cow as you can and be able to tell where the different colors are. Who has the best stable in the town? Why is it the best?

THE COW

ROBERT LOUIS STEVENSON

The friendly cow all red and white,
I love with all my heart:
She gives me cream with all her might,
To eat with apple-tart.

She wanders lowing here and there,
And yet she cannot stray,
All in the pleasant open air,
The pleasant light of day;

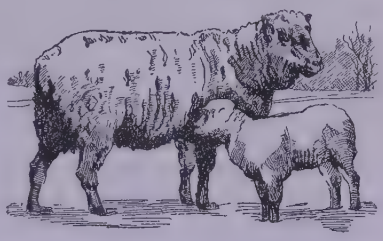
And blown by all the winds that pass
And wet with all the showers,
She walks among the meadow grass
And eats the meadow flowers.

Does she eat daisies and buttercups? Who can find out?

(c) SHEEP. How much of nature and literature and art are connected with sheep and the shepherd? Pastoral remembrances always include the sheep in the pasture, the shepherd, and the faithful dog. Let us deepen the child's interest in such country life pictures.

In some communities a pet lamb can be found. Make the most of this. Learn from the owner some of the habits

and interesting facts connected with his sheep raising. Many a farmer has a rich store of knowledge which he will share with the teacher if she will seek it. The important lessons on sheep for children in the lower grades will have to do with the habits and care. The uses of wool and practices of shearing will be interesting. Children will develop human interests in hearing the story of "Findlekind," by Ouida. It is a sad story, but young sympathies must be deepened and such literature helps. They should also know Wordsworth's poem, *The Pet Lamb*. No parody on this piece of literature nor any amount of careless familiarity can lessen its merit. Every teacher of little children should read this at twilight in a quiet place and perhaps something of the elevation of spirit that Wordsworth had will follow the reading. Simple, sweet, and deep is the message of the poem.



(d) The Dog. Perhaps no animal is more loved by young children than a dog, and many a schoolroom has been gladdened for an hour or two by the presence of one that is friendly and well behaved. Before inviting a dog to visit the school, the teacher should learn which one in the neighborhood is the most desirable. The boys and girls will be interested in the way the dog eats and drinks and sleeps; in his quick intelligence; in his love for his master. Very live discussions will take place if a little encouragement be given.

Children should be taught to take responsibility in the care of their dogs. When a boy becomes the master of a dog he must find out how to treat him. He should learn the diet of the dog from some one who has been successful in raising the particular breed considered and should follow directions given. He should learn the kind of shelter to give his dog. He should learn how to train him. He

should study the nature of his dog, for no two have the same dispositions; and he must bear in mind that his dog may not be able to do things that other dogs do.

If the teacher is interested in this subject for the nature study lessons, the following questions may be helpful in the observations made by the children:

(1) Give the dog a bone and notice how he holds it.

(2) How does a dog drink?

(3) Does he sleep much in the daytime? What position does he most often take when he lies down? Does he always choose the same place in which to rest? Can you give a reason for his choice?

(4) Have you ever tried to make a nice bed for your dog and has he arranged it afterward to suit himself? Do you know whether wolves make beds for themselves in the forest?

(5) Why should you keep fresh straw for your dog's bed and have his kennel whitewashed inside once in a while?

(6) Watch your dog hide a bone. How does he do it?

(7) Which dog do you think is best to have in the farm home? Why?

(8) If you live on a farm, you may know what a shepherd dog is. What breed is the shepherd dog?

(9) How many breeds of dogs are there in your neighborhood?

(10) How many have ever seen the wild relations of the dog—foxes and wolves? How many have ever seen a wolf that looks like a dog?

(c) The Cat. The value of the household cat has, in the minds of many persons, been much overestimated. Doubtless it has grown in favor because it has been the only pet that some children have had. When education teaches the joy in making pets of the birds, chickens, lambs, and many useful forms of life, the cat will be less in demand.

There are many objections to having cats about, all of which are well founded. The good she does in disposing of rats and mice can be met by other means. Certain it is

that there ought to be fewer cats, and owners should be induced or even compelled to prevent them from roaming at large and becoming the public nuisance that they are in many places.

The destruction of the birds by cats is very great. In many places the time has come when it is almost necessary to decide whether we shall have cats or birds. No community can afford to lose the birds. Facts along this line of thought should be taught in our schools, and the children should learn that it is cruel to allow cats freedom during the nesting season, particularly at night—not only cruel, but a wrong in every way to the neighbors.

A cat might be kept in the terrarium cage for a few days in order that the children may study her habits. They will see how the structure of her feet and sly ways enable her to steal upon her prey. A bell kept on her neck may protect the older birds, but what about the young birds at night in their nests in the grass or trees?

(f) Rats and Mice. While the work in nature study in the lower grades should always consider the study of life and not include taking life, the truth must always be presented, and even the young children can share some of the responsibility in destroying animal life that disturbs our homes and farms. Much unnecessary cruelty has been and is practiced in this connection. Part of the nature study teaching must be from the viewpoint of the animal that is at the mercy of man. Truth, justice, and humane treatment can be taught without danger of sentimentality.

The habits and food of mice will interest the boys and girls. They will enjoy the field mice very much, and the study of the food will have to do with the out-of-doors. The children can experiment by offering the mice seeds of weeds, nuts, grains, and the like. Will field mice eat insects?

The field mice are most interesting. They are not likely to live long indoors even in the terrarium, but as one comes into the school by way of some young naturalist, its habits can be studied.

(g) SQUIRRELS. A trip to the woods in autumn will often give opportunity to watch a squirrel or chipmunk. A caged squirrel is living in such an abnormal way that if children can not study one in the open other animal life might better be substituted.

Squirrels are easily tamed, and the boys and girls will enjoy making a feeding ground for them. An old-fashioned mother who liked to sew on her lawn on summer afternoons always placed some nuts near the edge of her skirt as it lay on the grass. The squirrels accepted the invitation, and it was a pleasure to see the sociability that existed between the little wild creatures and the calm, sweet woman who understood them. A college girl has often watched a squirrel enter her dormitory window in the moonlight in search of nuts left on her desk. Who has not watched some nature lover feeding the squirrels in the parks?

Some things to have in mind in teaching about the squirrels and chipmunks are the following:

(1) The food—nuts, acorns, and the like.

(3) It is said that squirrels plant trees; how?

(3) They can be tamed by establishing feeding grounds near school or home.

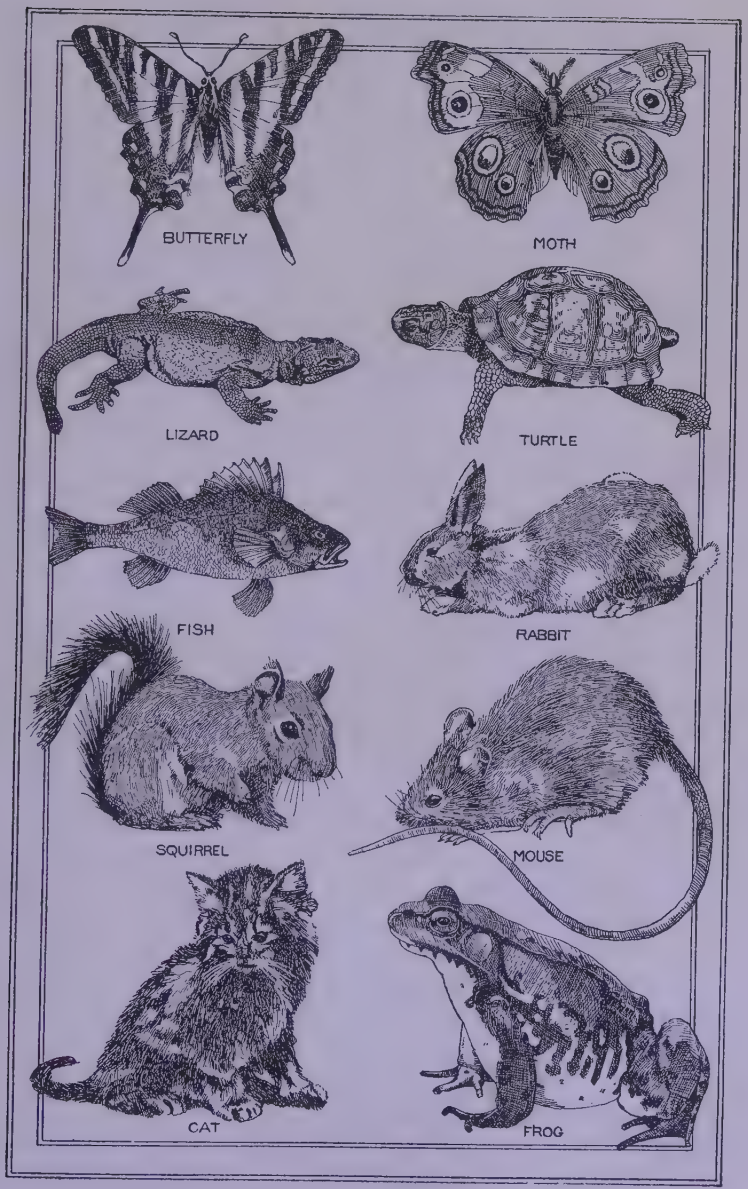
(4) The red squirrel does some harm in mischievous ways to fruit trees. It is said he robs birds' nests; how true is this?

(5) Professor Hodge advises us to encourage the gray squirrel and fox squirrels, which have a better reputation than the red squirrel.

(6) Does the red squirrel hibernate? How about the chipmunk? The gray squirrel? Have you ever seen a red squirrel in the wood on moonlight nights? Does he chatter then? Do squirrels make nests for the young?

(7) Notice the stripes on the back of the chipmunk? How many are there?

(8) Does the chipmunk always know where he puts his stores? Are the chipmunks solitary or social in their habits?


BUTTERFLY
MOTH
LIZARD
TURTLE
FISH
RABBIT
SQUIRREL
MOUSE
CAT
FROG

(9) In what way do squirrels, rabbits, and mice resemble each other?

(h) Rabbits. Children usually know a good deal about rabbits, and before attempting to teach anything about them it would be well to find out what the class knows. If a rabbit is kept in the schoolroom a day or two, the children will discuss his ways. They will bring something for him to eat, and be interested in making him comfortable. The teacher might have in mind the following, by means of which observations of the rabbit at school or in the open may be directed:

The rabbit is related to squirrels and rats and mice. Can the children note similar structure and habits in these animals?

Why are Bunny's long hind legs a help to him?

What enemies has a rabbit?

What does he eat?

What harm does he do in orchard and garden in some places?

How many kinds of rabbits do the children know?

What kind of tracks does Bunny make in the snow?

Note. It will not be necessary to have the young children learn the difference between rabbits and hares.

31. Insects. Insect work of value for young children is that taken up in connection with gardens, either a school garden or one at home. Who will take a bottle from the nature study table and bring to school a caterpillar ("worm") feeding on a cabbage leaf? Place it in the cricket cage with some cabbage leaves and watch the caterpillar feed. It may change to a chrysalis and then to adult form. If eggs can be found, the children will have seen the complete metamorphosis of one butterfly and this will count more for the future observation of insect life than to know any number of insects by name.

Who can find a caterpillar feeding on milkweed? The larva of a Monarch butterfly may be the result of the quest. Keep this in the schoolroom—feed it fresh milkweed leaves and watch what happens. If the chrysalis develops put it into

the terrarium. The Monarch butterfly will sip sweetened water and the children will enjoy seeing it put out the long tube by means of which it takes its food. Have all this work very simple.

Who can find a potato beetle? Have a potato plant brought with it and note the development of the insects from day to day. Can any one find a lady beetle? Teach that some lady beetles help the young gardener. How?

Who can get a housefly? A mosquito? A moth that flies around the candle at night? These insects will remain alive a long time in a bottle and every child may have an opportunity to see them. The insects will have enough air even if the bottle is corked.

Even the young children should know what serious pests are mosquitoes and houseflies. They should learn that manure heaps in which houseflies breed and stagnant water in which mosquitoes breed are menaces to the public. Every one, young and old, must work together to rid the country of pests. Teachers should read in some good reference work the latest viewpoint on the mosquito and housefly, and should learn how and where they spend their lives. Children in the country need this work quite as much as the children in the cities. They need also to share the responsibility of making their world a safer, cleaner place in which to live. See *Lessons on the Mosquito*, page 121, and *Lessons on the Fly*, page 106.

Moths and butterflies have great interest for little children. Many of these insects are large and handsome, and the children learn quite young the marvelous life history which is often demonstrated in a schoolroom. Teachers often make mistakes in statements connected with the metamorphosis of a moth or butterfly, speaking, for instance, of a butterfly as coming out of a cocoon, and the like. It will be well, therefore, if the teacher will learn carefully the following facts and try to fix the knowledge by personal observation:

The most important thing to remember in the study of moths and butterflies is that they appear in four different

forms during their lives. These forms are the egg, the larva, the pupa and the adult.

The Eggs. The eggs are laid singly or in clusters. They are usually found on the plant which is the favorite food of the young. Look for the shining masses of the eggs of the tent-caterpillar on apple and wild cherry trees; the long, small, pale yellow egg of the cabbage butterfly on the cabbage leaf.

The Larva. The larva, or "worm," hatches from the egg. During this period in its history the insect eats and grows. If you doubt that they have good appetites, undertake to feed a few healthy caterpillars in the spring. If you doubt that they are particular as to the kind of food they have, find out for yourselves whether the apple tree "worm" will eat milkweed leaves or whether the milkweed caterpillar will eat leaves taken from an apple tree.

A PUPA

One of the most interesting things to notice in the study of the larvae of caterpillars is that they occasionally appear in bright new coats, and we find that the old ones have been cast aside. An insect's skeleton is on the outside of its body, and this comes off to give it room to grow.

The Pupa. Of all the forms in which moths and butterflies appear, the pupa is the strangest. Although we speak of this period in the life of the insect as one of rest, it is the time when the most wonderful changes take place in its body.

The queer little object that you see illustrated here is the pupa of the mourning-cloak butterfly. When the caterpillars were about to shed their coats for the last time, they hung themselves head downward from a twig by means of a silken button which they had spun. Then they cast off their skins, leaving the chrysalids or naked pupae hanging; protected from birds by their spiny form, and protected from

many enemies, even from young naturalists, by their wood-brown color which so closely resembles the support from which they are suspended.

Let us next look at the pupa of a moth. This is often inside a covering which is called a cocoon. If you look on the fruit trees or shade trees about your home you may find a cocoon of the cecropia moth. You will see that it is made of silk. This covering was spun by the giant silkworm as a protection against the storms of winter.

When you are studying pupae remember that butterflies do not come out of cocoons. Their chrysalis, or pupa, is always uncovered. In the case of moths, however, the pupa is either inside a cocoon or protected by being underground or in some well-sheltered place.

The Adult. We now come to the fourth period in the lives of moths and butterflies, a period which has ever had and ever will have an interest for young and old. Since there are many persons, young and old, who can not distinguish between the two groups, butterflies and moths, let us learn the marks by which they may be known.

Butterflies have uncovered pupae; they fly by day. The wings are folded over the back when at rest. The antennae or feelers have knobs on the ends. The body is slender.

Moths have pupae either inside cocoons or protected by being underground or in some sheltered place. Many moths fly at night. The antennae are never knobbed. They leave the wings spread when they are at rest. The body is stout.

Occasionally you may come across insects that very closely resemble butterflies, yet have some characteristics that are similar to those of moths. These are the skippers, so named because of their strong and rapid flight. The antennae have knobs, but these knobs are drawn out and turned back in the form of a hook. The body is rather stout. The pupa is covered by a thin cocoon. In some species the wings are held vertically, in others horizontally. From the excellent works on insect life, teachers can learn to direct observations of moths, butterflies, ants, bees, and other insect forms.

REFERENCE BOOKS

1. Nature Study and Elementary Agriculture

The Nature-Study Idea. Bailey. The Macmillan Company.
Nature-Study and Life. Hodge. Ginn & Co.
Handbook of Nature-Study. Comstock. Comstock Publishing Co.
Elements of Agriculture. Warren. The Macmillan Company.
The Great World's Farm. Gaye. The Macmillan Company.
Sharp Eyes. Gibson. Harper & Brothers.
Eye Spy. Gibson. Harper & Brothers.

2. Plant Life

Manual of Botany. Gray. American Book Co.
Our Native Trees. Keeler. Charles Scribner's Sons.
Trees of Northern United States. Apgar. American Book Co.
A First Book of Forestry. Roth. Ginn & Co.
Manual of Gardening. Bailey. The Macmillan Company.
Field Book of American Wild Flowers. Matthews. G. P. Putnam's Sons.
How to Know the Ferns. Parsons. Charles Scribner's Sons.
Mushrooms. Atkinson. Henry Holt & Co.

3. Animal Life

Handbook of Birds of Eastern North America. Chapman. D. Appleton & Co.
Bird Neighbors. Blanchan. Doubleday, Page & Co.
Bird Homes. Dugmore. Doubleday, Page & Co.
Manual of the Vertebrates. Jordan. A. C. McClurg & Co
American Animals. Stone & Cram. Doubleday Page & Co.
American Food and Game Fishes. Jordan and Everman. Doubleday, Page & Co
The Reptile Book. Ditmar. Doubleday, Page & Co.
Types and Breeds of Farm Animals. Plumb. Ginn & Co.
The Horse. Roberts. The Macmillan Company.
Insect Life. Comstock. D. Appleton & Co.
Moths and Butterflies. Dickerson. Ginn & Co.
The Spider Book. Comstock. Doubleday, Page & Co.

4. Earth Science and Astronomy

Physical Geography. Tarr. The Macmillan Company.
Soils. King. The Macmillan Company.
The Children's Book of Stars. Milton. A. & C. Black.

5. Nature Poetry

A Child's Garden of Verses. Stevenson. Charles Scribner's Sons.
Songs of Nature. Edited by John Burroughs. McClure, Phillips & Co.
Nature in Verse. Comp. by Lovejoy. Silver, Burdett & Co.
Poetry of the Seasons. Comp. by Lovejoy. Silver, Burdett & Co.

TEST QUESTIONS

1. Give five reasons of your own to prove that nature study has educational value.

2. In what ways is the study of animals more desirable than the study of plants for pupils in the lower grades? The study of plants more desirable than the study of animals?

3. Explain some of the advantages of a terrarium in the schoolroom.

4. Mention at least three things that you have learned from the sketch of the robin.

5. Why should birds be protected? What can you do to secure an interest in their protection on the part of your pupils?

6. What instructions do children need to enable them to observe birds carefully? What should be the teacher's preparation that she may give these instructions?

7. Do you have a dread of caterpillars and worms? Is it necessary for you to overcome this?

8. What animals are injurious to growing crops? To poultry? Do these animals in any way compensate the farmer for what they destroy?

PRACTICAL STUDIES

BY

Charles F. Hodge

Lessons on the Grape

1. Mabel Musser, aged fifteen, prize gardener of a city school, reported her garden account. It showed that during the season she sold bedding plants, flowers and vegetables to the amount of $161.85 from a plot of ground 52 feet square. (How much does this represent per acre? Ans. Nearly $2,600.) A child might thus actually produce from a small garden at least $1,000 worth of fruits, flowers and vegetables, as a most vital part of his education for citizenship, between the ages of six and twenty-one. From every point of view no movement in modern education has larger possibilities for every sort of human good than that for children's gardens. The distribution of flower and vegetable seeds in the spring and of bulbs in the fall is a matter of regular routine in many schools.

2. To add an element of permanence and thus develop attachment to the home, the planting of trees should always be advocated, especially nut and fruit trees, and perennial shrubs and vines. Where there is not room for the larger trees, dwarf varieties offer fascinating possibilities; and about every home with a few feet of ground, gooseberries and currants, blackberries and raspberries and the many novelties in this line, are well worth intensive culture.

3. Of all these permanent garden and home types the grape is by far the best. It is still in its youth at a hundred years, and vines have been known to live for four, and even for six, centuries. Since a grapevine requires only "standing room" and will grow almost anywhere, there is no reason why every school boy and girl in the country should not have a pet grapevine to feed, water, prune and train; to learn how to care for from the age of five or six till he leaves home.

Photograph by C. F. Hodge

LIVING DECORATION OF A DINING PORCH

And when he makes a home of his own, will he not wish to take with him a layer or cutting of the old vine?

The suggestion is often made that the grape was possibly the first plant to be domesticated by man. Quite probably it supplied the first primitive summer arbors for the race, and we may imagine that an exceptionally good vine, growing over the mouth of a cave, determined the choice of the first permanent human home. Possibly some boy or girl discovered a vine of rare flavor and excellence and, with sticks and sharp stones, dug up a rooted branch and carried it to their home cave, the first specimen to be transplanted by the hand of man.

Thus, while the children are tending their grapevines they may be rearing something even finer and more beautiful—a fruit of the spirit—the love of home and of country, in their own hearts; and we can not grow too much of this to counteract present tendencies toward irresponsible tenement-house life. Love of home is the very breath of life, of patriotism and of national existence.

4. How many of the class already own grapevines? Let all who have them tell or write about them—how, when and where they got them, how they chose a place for planting, just how they dug the hole, what fertilizer they used in it; how they prune and train their vines, how they care for them, water, fertilize, spray, and protect them in winter. Bring out, if possible, about how much time the care of a grapevine requires in a year and how many grapes each vine produces yearly?

5. From fifteen minutes to one hour a year will suffice to care for a vine, and, while field vineyardists consider twenty pounds per vine a good crop, it is on record that a single Concord vine has covered a trellis 48 feet long so black with well-grown and perfectly-ripened clusters that, as someone has said, "It was like walking through a tunnel in a coal mine." A low estimate would be 500 pounds, or ten bushels of grapes from the one vine. A mission grape, planted by a Spanish woman in southern California in 1842, cov-

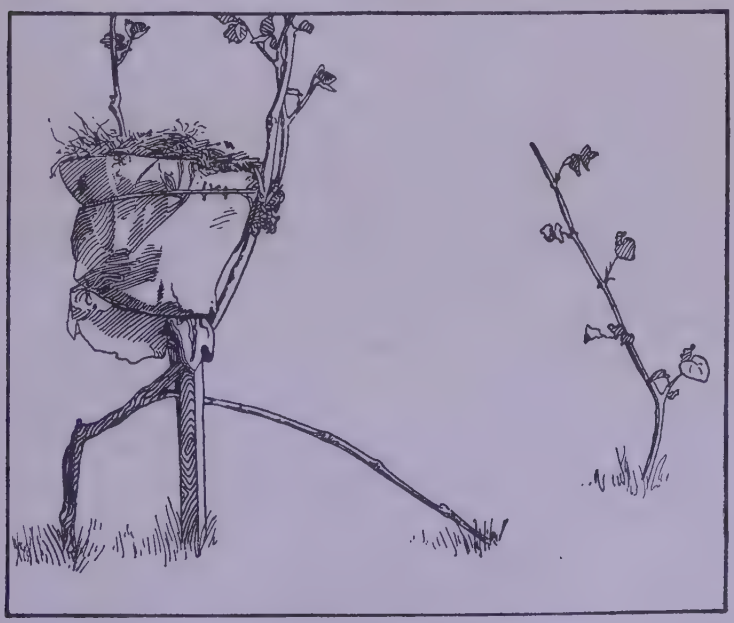
ers a trellis more than one-half acre in extent, under which meetings and conventions are held; its fifty-third year, in 1895, was notable for bearing over 20,000 pounds of grapes. Field culture may keep the vines small and low for convenience in handling, but in these home vines we may work for fine, large specimens, trained to cover porches, bare walls and roomy back-yard arbors. Among our corn clubs and our tomato clubs and the various garden games and competitions, why not see who can make his grapevine grow the best, train it most artistically, and, after two or three years, see who can produce the greatest amount and the finest fruit from a single vine? In all such trials of skill, however, we must be careful not to let the young vine try to bear too heavily. Overbearing may weaken a vine so that it may not recover for years.

6. A vine should not bear any fruit the first season after transplanting; the second year it may be allowed to bear from three to six clusters, according to size and vigor; the third year, about ten pounds; the fourth year, twenty pounds; and even after that it will be best to cut off from half to three-fourths of the blossom clusters to insure against overbearing. The idea is that a young vine will throw all the strength that it ought to spare into a limited number of fine clusters, whereas, if it tried to do too much, the quality of all would be poor or it might not be able to ripen any properly. Ripening the fruit and the wood promptly in the fall is the test. If, when ripening begins, a vine does not ripen every cluster within two weeks, at longest, it is trying to carry too much, and all green bunches must be promptly cut off; otherwise it may not be able to ripen its wood and may be permanently injured.

Study well-kept vines in the neighborhood, to learn how they have been pruned and trained. Possibly there are neglected vines about some of the pupils' homes which they can have if they promise to take care of them. By digging around them, fertilizing the ground and pruning, they may have fine bearing vines the second, or even the first, season.

After the children get interested and full of questions, ask some vineyardist to come to the school and tell them all about the best local conditions, soils and exposures, methods of culture, and about the varieties best adapted locally for hardiness, vigor of growth and quality of fruit. In this way the children will learn the kinds that are most certain to succeed, and also those that ought to be tried and experimented with, in order to improve the quality and variety in the neighborhood. This is just the kind of work the children ought to be doing, and how proud and happy a child will be, if, at the annual grape show, he is able to exhibit the finest and most luscious grape ever known in the district, and furnish his schoolmates layers and cuttings and tell them how to grow the new variety!

7. The best way to obtain a new vine is by "layering." Select a strong branch of the variety desired, preferably one



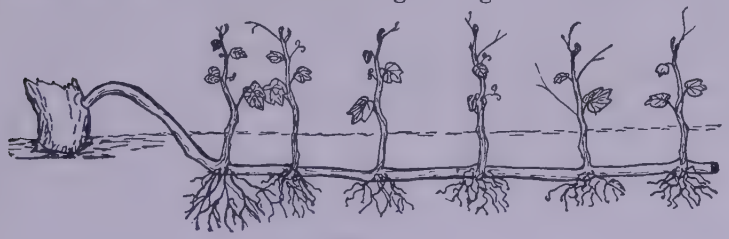
TWO METHODS OF MAKING A GRAPE LAYER

that starts near the ground, about the time the buds shoot in the spring; make the ground rich and fine and in it bury about four or five inches deep a bend of the branch, about two feet long. Keep well watered, but not too wet. Cut from parent vine when leaves drop in the fall, dig up very carefully, saving all the roots and not exposing them to the air a moment longer than necessary; then transplant into a hole, already dug, where it is to grow permanently. A strong layer, made in this way, may be allowed to bear two or three clusters of grapes, possibly, the first season, and may be two full years ahead of an ordinary vine such as one is likely to buy. If the ground is made rich close to the layer, the roots will be short and very numerous so that it will be easy to save them all and transplant with scarcely any shock to the plant. If a branch can not be brought down to the ground, it may be put through the hole in a flower pot, before the buds start, supported in place, filled with rich earth, packed with moss and wrapped with paper; a fine pot-grown layer may be secured in this way. It must, of course, be watered carefully all summer. Both methods described above are illustrated here. As many plants as there are joints, or buds, may be obtained by burying the whole branch, cutting the vines apart in the fall.

LAYER OF WORDEN GRAPE, AUTUMN AFTER LAYING

8. Grapes may be much more rapidly multiplied by cuttings, and this is the common method employed. Just for the sake of learning how, each pupil ought to try, at least,

to root ten cuttings. Any quantity of propagating wood may be obtained free when vines in the neighborhood are being pruned in the late fall. Cuttings must always be made from the season's growth, well ripened. Beginning at the lower end of each cane, cut off about one-half inch below the first bud, then a half inch below the fourth, seventh, tenth, and so on until the cane begins to grow smaller. Throw



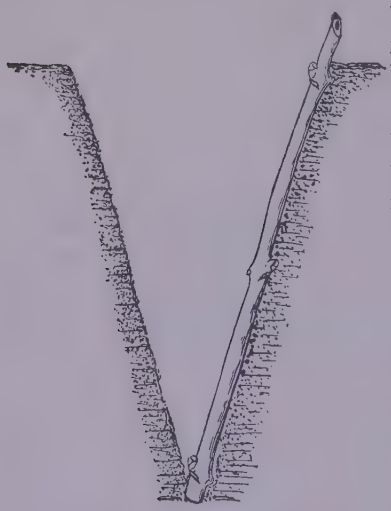
GRAPE LAYER
See preceding page

away the small end. We can thus recognize the lower, or butt end of each cutting and plant it down, *i.e.*, right end up. For over winter, tie the cuttings in a bundle and bury butt ends in the garden where no water will stand.

As soon as the ground can be worked in the spring, dig a row very deep and fine, make a V-shaped trench and set the cuttings as shown on page 98, about six inches apart in the row. In filling the trench press the earth firmly about the butts of the cuttings with the foot, and fill so that the top bud is just even with the surface. With good cultivation and watering, if too dry, well-rooted vines may be obtained, which may be transplanted in the fall. Of course the cuttings may be set where they are to grow, but it is generally more trouble to take care of them.

9. With good care seedling vines may be grown almost as quickly as cuttings, but there is no telling what kinds of grapes they will bear. Three seeds from the same grape may produce three different varieties. This is the most interesting method of all, and one that ought to be indulged in by the boys and girls of the country much more than it is. The fact that many good people raised their vines from seeds

fifty and seventy-five years ago has given us our present fine varieties. Ask some pupil to hunt up and tell to the class the story of the Concord grape, which was originated by Mr. Bull of Concord, Mass. How many Concord vines are there now in the whole country, and how much has the Concord been worth to the American people since its discovery? Does any member of the class know of any good variety which has been originated in the neighborhood? Has anyone found wild seedling vines that showed vigor of growth, productiveness and better quality of grapes than usual? In the October grape-shows one of the most interesting features will always be the exhibition of the different kinds of wild grapes to be found in the district. Not one chance seed in thousands is likely to produce a better grape than the Concord, but we never can tell which one may excel it.



SETTING A GRAPE CUTTING

10. The real purpose in directing attention to seedlings is to interest the pupils in plant breeding, and this is the road toward continued improvement of everything, from the lowest types of life upward. We must first breed our seeds. How many of the class know anything about breeding plants? How many have tried to raise pure-bred poultry, pigeons, rabbits or anything else? Stories giving the main varieties or breeds of fruits, flowers, grains, vegetables, dogs, sheep, cattle, horses, poultry, are often the most interesting stories in the world. Read or tell the best story you can find and ask your pupils if they know or can find out about the production of new varieties in the neighborhood.

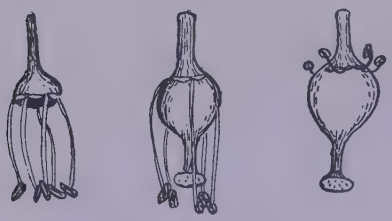
Have them ask their mothers and fathers, grandmothers and grandfathers about it.

While chance seedlings tend to strike back—"revert" to their ancestor, the wild grape, from which they have all come—seeds from carefully bred and selected parent vines are more likely to produce something of value. Excellence of grapes, as well as of pupils, may be expressed on a scale of ten from poorest to best. This has been done, and we find that the little Delaware stands at the head of the class, "No. 10" for quality of fruit. Concord is rated at "5-6," only about half as good. However, in other good characteristics, as vigor of growth, Delaware is only "4," and in productiveness "8," while the Concord is "10" for both these valuable qualities. In size of berry, the Delaware is only scaled "4," while the Concord is "8." In other words the Delaware is a little, delicate though productive grape of best quality, while the Concord is a big, strong grape of poor quality. By crossing the two, we may produce a grape combining the size and vigor of a Concord and the flavor and sweetness of a Delaware; or, we may get something stronger and finer than either.

GRAPE CUTTING

To do this will take patience, but that is the best thing we can cultivate. Choose the finest Concord and Delaware vines to be found and give the best of care. In June watch the fruit buds closely and a little before they burst on the Concord, select the finest cluster and gently pry the petal-cap off from each tiny bud, and, without injuring the pistil, pull off all the stamens (a pin with a tiny hook bent at the point is the best instrument with which to do it), tie a tissue-paper bag over it so that no chance pollen can gain access to the flowers of this cluster. Also bag five or six clusters on the Delaware to make sure that no insects bring pollen

from other grapes When the clusters, both bagged and free, are in full bloom, the pollen is being shed and the tips of the pistils are moist. At this time clip the bagged clusters from the Delaware, and, removing the bag from the Concord, touch the opening stamens of the Delaware to the pistils of the Concord, slip the bag over the seed cluster again and wait for the seeds to ripen. In the fall the seeds should be washed so as to be free from pulp, then mixed with clean, slightly moist sand and kept in a cool corner of the cellar. In February or March they may be planted in flats in the house or in a greenhouse. With this early start they will make strong vines which should begin to bear the third or fourth season. Then comes the caretul study of quality, and the saving of the best.



GRAPE BLOSSOMS

11. Many details will have to be learned from books, but careful examination of grape blossoms of different varieties, both wild and tame, will be enough to make a beginning. The kinds to be bred together will require special study in each locality, and some authorities even claim that chances for improvement are better if a strong pistillate variety, like the Brighton, Lindley or Iona, is bred with a vigorous wild staminate vine.

To carry experiments through with seedlings will require five to seven years, but the work is highly interesting and instructive and will need little time each year. If it is begun in the seventh grade, the pupil can be reasonably sure of having a result by his third year in the high school, and pupils in the high school might breed the seeds for their brothers and sisters in the lower grades to plant, under careful direction. It is the trying that is worth the while.

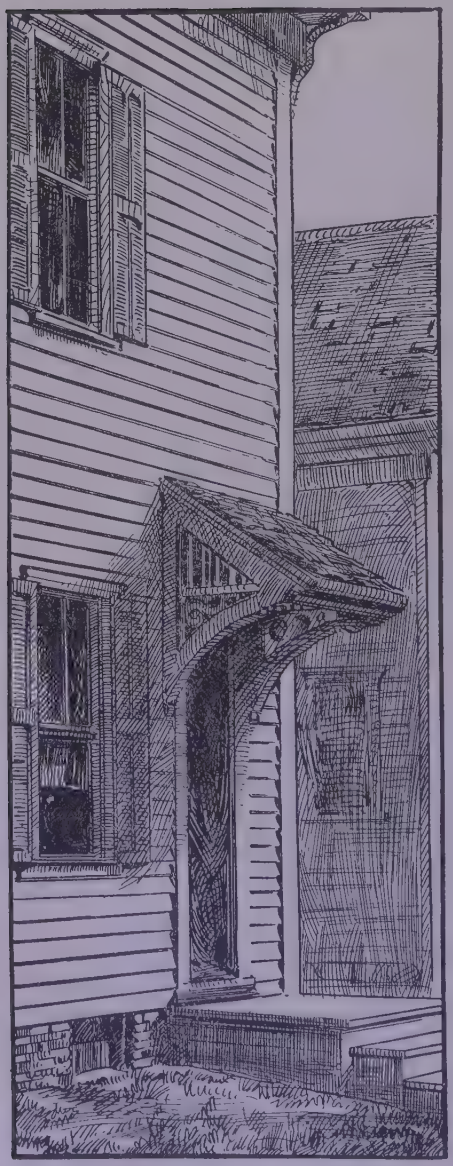
Of course vines one or two years old may be purchased for from ten cents to a dollar each, according to variety.

Practical growers insist that well-started vines one year old are better for transplanting than those which are older and larger, because the feeding roots are then close to the stem, whereas, in the older vines, they will have pushed farther out and be cut off.

12. Large numbers of vines to supply the children of a town or city school may be obtained at from $18.00 to $50.00 per thousand, according to variety. Often public-spirited people, or a storekeeper, for the good of the cause or for the advertisement, will offer to give the children fruit trees or grapevines, if they will plant them. This generally results in total failure. The work requires careful supervision at the start. The stock must be the best; it must be handled properly at every stage; the children must be instructed and they should have the holes already prepared before the trees or vines are distributed. As the package is opened, the roots should be dipped in water and at once wrapped tightly in newspapers for the children to carry home, care being taken not to allow the roots to dry out.

13. Grapevines are machines, alive with the passion to turn sunshine into cool leaves and grapes. They love the sun—east, south or even west—and cannot do their best without it. In every town or city there are whole square miles of hot, bare house, stable or building wall burning, cracking and blistering in the summer sun. The grape is the vine whose large shingling leaves give perfect shade and perfect ventilation. The temperature of a house may be reduced by the shade as much as 14 degrees on the hottest days, and if all these hot walls were covered, the furnace-like air of cities might be made as cool and fresh as that of the woods. Plant so as to shade the hottest wall on the place.

If the soil is naturally good, a hole 18 inches deep and wide is all that is required. If the subsoil close to the surface is barren sand and gravel, a hole three feet deep and wide will be none too large. We can never get at it again after the roots take possession, and the satisfaction of seeing the vine in luxuriant growth will amply repay extra digging. Save all



A VERY FAMILIAR TYPE OF REAR ENTRANCE, WITHOUT ORNAMENT OR PROTECTION FROM THE SUMMER SUN.

bones from the kitchen and put a bushel of them into the bottom of the hole; also mix an equal quantity of hard wood ashes with the rich garden loam with which the hole is to be filled. When the hole is filled to the depth which will allow planting the vine as deep as it was in the ground before, heap up a little mound in the center so that as the filling and setting is completed the roots will slant downward as they grow; spread the roots naturally and tramp the earth firmly around them.

14. The best time to transplant a grape-vine is in autumn, after the leaves have fallen; before winter sets in heap the earth over it so as to bury the top completely. The rule in transplanting a vine is to cut it back to two buds, but it must

not be cut at all in case of fall planting. In the spring draw the earth away from the vine and as the buds swell, rub off all but the two strongest ones that start close to the ground, and, after these have made five or six leaves, pinch off the top of the weaker one and train up the other in the way it is to grow. Spring planting is good anywhere and may be preferable to fall planting in some localities.

15. John Burroughs says: "If we train a Gaertner *up*, it will grow to the top of Washington Monument in a season." In nature the wild grapevines luxuriate over the tops of the tallest forest trees. It is this principle of upward growth which will cause so much larger specimen vines to be produced on house walls and porch awn-

THE SAME ENTRANCE, WITH LOVING CARE, HAS BEEN TRANSFORMED INTO A BOWER OF BEAUTY AND USEFULNESS.

ings than are commonly seen on vineyard trellises. With unlimited possibilities of feeding and watering the few vines about a house they can be grown as large as is desired and trained up to form beautiful, cool, green awnings for second, third and even fourth story windows and porches, and then will go on to canopy a roof garden. A single bud has been known to throw out 63 feet of cane in a season.

ONE YEAR'S WORK OF A GRAPE BUD

16. In the accompanying illustration is shown the year's work of a grape bud—four clusters, twelve ounces, of Delaware grapes and about six feet of vine. This bud could not have done so much if many other buds had not been trimmed away. The work of one bud thus gives a measuring stick by which to prune. In pruning in the fall, until a vine becomes large and strong, do not leave more than from fifteen to thirty buds to bear fruit the next season; therefore, prune away entirely all weak canes and cut back, say, the five or six strongest canes to three, four or five buds each, according to the age, strength and vigor of the vine. The fruit is grown on the new shoots of the season which spring from the canes of the previous year's growth. "Suckers" which start from the root, or "water shoots" that grow out from the old wood

of the trunk, do not bear grapes. They may be valuable, however, in renewing the trunk, in training to reach higher porches or windows, or in making layers.

17. In training over walls and buildings the vines should be supported on wires so as to stand a foot from the surface. This will do away with all objections with reference to causing decay of wood, injuring paint, making the wall damp, staining and so on. Some have claimed that such climbing vines as Virginia creeper and Ampelopsis, which cling by tendrils that root in the surface of the wall, injure brick, mortar and paint, but grapes climb by twining tendrils and so do no damage of this kind. Neither do grapes pull down and break things like wisteria, bitter sweet and actinidia, which wind and twist around their supports. The grape is thus the best natured, the gentlest and most plastic vine in the world to train. We can lead it, train it, change it about from year to year wherever we need the shade. All summer grapevines will cover us with the most perfect shade of any awning we can provide, and then drop their leaves promptly to let in the fall and winter sunshine.

18. Ask your pupils how many of them have all the grapes they want to eat and use at home. Do they raise them or buy them? How much would a year's supply cost? To what uses are they put in the different homes? Grapes are now used in so many ways that no one can object to raising them on the ground of temperance. They are our most nutritious fruit-food and so wholesome that "grape cures" have been developed for pulmonary tuberculosis and other ailments. Every family of ten ought to use at least 2,000 pounds of grapes a year, eaten fresh from the vines and in the form of jams, jellies, butters, raisins, preserves and above all, in unfermented grape juice, a most refreshing and wholesome drink.

19. A number of insects and a few fungi attack the grape. It will be best to ask the pupils to write to their government experiment stations for the latest information on these subjects. Hunt up, and have your pupils search for all the books,

bulletins and magazine articles in local libraries which deal with grape culture. Set each pupil some point to look up and report on to the class. Focus all information gained on raising the best possible grapes for the locality. Get the vines; plant, and take good care of them; study them, and they will be your best teachers. The grape has probably taught the human race longer and more than any other plant in the world.

Lessons on the Fly

1. It may seem strange to call the apparently harmless fly, which can neither bite nor sting, the most dangerous living thing in the world, yet this is true. During the Spanish-American war it earned the name of "typhoid fly" by wounding 20,738 soldiers and killing 1,580, many more than the number of American soldiers who were hit by Spanish bullets. It has been estimated to cause one-third of the 500,000 cases of typhoid, with nearly 50,000 deaths, annually. It is claimed to be practically the sole carrier of infection for the millions of cases of summer dysentery, cholera infantum—"summer complaint"—that kill 56,000 human beings, chiefly babies, every summer. It causes an unknown number of infections of tuberculosis and practically all filth diseases. A near relative, the stable fly, has been convicted of carrying the germs of infantile paralysis. Flies are probably even more active in carrying diseases like hog and fowl cholera to animals, because they are not even partially protected by screens and the pests are allowed to swarm at will about their living and feeding places. We are likely to see a wonderful clearing up of animal diseases when flies are exterminated from our farms.

Can any member of the class think of another animal or insect that causes anywhere near this amount of disease and death?

2. Discuss with the class, in a tactful way, the health of the district with reference to flies. Have there been any

cases or epidemics, among people or animals, in which flies may have been the agents or distributers of the infections?

All the above means that we must free our homes and keep our foods clean of flies, no matter what it costs or how much work it may take. It is no longer a solution of the problem of homes to screen windows and doors so long as flies are swarming over exposed foods in stores and markets, on the farms and in dairies. The movement against this enemy must be community-wide, and since, as we shall see, one ignorant or careless household can breed flies enough to vitiate the work of the rest of the community, positively all must coöperate. Not any of us can afford to be ignorant or careless when such vital matters are at stake. Fortunately, with the means now at hand, extermination of the house and stable flies is one of the easiest problems in the whole field of insect life, if we can secure coöperation of every member of the community. Hence, the main problem is to devise a plan good enough to enlist everybody in the work.

Why not put the flies in jail and help ourselves to be free? This question started the author's whole scheme of fly-extermination.

"Why does not everyone do his part?" The answer is: "The people cannot realize it; they do not really believe that the common fly is doing so much harm." Here is a typical case that ought to convince everyone and show the need of country-wide coöperation. We quote entire from the Indiana Board of Health Bulletin, July, 1910:

THIS HAPPENED IN INDIANA

"A few days ago a physician in Martin County called on the State bacteriological laboratory for Flexner's antimeningitis serum. Dr. Simonds went to the case and found a seven-months-old baby suffering from a very severe gastro-enteritis with the not infrequently accompanying meningism. The father of the child was a farmer living in a four-room house with few or no modern conveniences. On the wall of the largest room was a family history chart done in brilliant colors, with three columns of lines for the record of marriages, births, and deaths. The parents had been married ten years and six children had been born to them. In the death column were the names of four children, all under two years of age. Another name has since been added to this list.

"The cause of this sad story became evident on inspection. There was a shallow surface well in the back yard, a short distance from an open privy. A large pile of manure lay uncovered, almost against the side of the barn. If this farmer had attempted so unthinkable a thing as transforming his premises into a fly hatchery for commercial purposes he could not possibly have achieved a more brilliant success.

"The family and several of the neighbors were eating dinner on the back porch. Flies were swarming all over the table, but showed a special liking for a particular dish. They were so thick on this dish that it was absolutely impossible to tell definitely what it contained until one of the neighbors swung her arm over the table and cleared them away long enough for one, by looking quickly, to see that the dish contained cottage cheese. The flies were so thick in the house that it was only with difficulty that they were fought away from the field of the spinal puncture and kept from lighting on the instruments.

"On the death certificate the cause of the death of this child was doubtless given as 'Gastro-enteritis.' It would have been more in keeping with the facts to have said, 'Poisoned by Flies.' "

The fact that out of six children, five died under two years of age, is but a small part of the whole story. This farmer may have been producing milk or other dairy supplies, such as "cottage cheese," and for years have been scattering similar filth-disease and funerals chargeable to flies, among the people of a near-by city.

4. Taken all in all, it is a low estimate to say that this filthy insect is costing the United States and Canada 70,000 lives and $300,000,000 annually in preventable sickness. Even this total is not the worst feature of the situation.

Health authorities everywhere are saying, in effect: "*Clear the air of these universal distributers of filth-disease infections and then we can see clearly to trace out the other means of infection.*" Hence, fly extermination comes to be, in plain, common-sense fact, the necessary first step in the great modern work of disease prevention and in conservation of national health.

5. One bright boy or girl in every family, with some help at the start to secure the proper apparatus, with effective backing by sanitary police and health officials, can exterminate the flies about his home by the first of June, or within about two weeks at any time during the summer, by attending to this work for from ten minutes to one hour a day, according to the seriousness of the situation. The difficulty is in enlisting the one person in each family. This will be a different problem for each city, town or neighborhood, but the only hope of success seems to be by working through the schools. Churches and civic associations, health authorities, the police, and especially the newspapers can all help, but the school comes nearer reaching every home than all other agencies combined. This point must be clear. As things are now, practically every person who thinks at all, is saying: "I would like to get rid of the flies and am willing to do my share, *but* the Winslows will not do anything; they will keep on feeding and breeding them, so *What's the use?*" How can we get everyone to feel that the matter is worth while, that everybody is going to be doing it, and that the success of all depends on each one playing his own part well?

The Winslows, next door, are saying, "We would take care of the flies on our place, but, while the Clarks would do the right thing, in the tenement on the other side are three families of Italians; they are not keeping the place clean, and if we set traps, we would be catching their dirty flies all summer." And they may not stop to think how much safer it would be to catch the "dirty flies" than to have them on their foods and crawling all over them the whole summer long. But, while it is a hard problem, it is well

worth while for a community to be wise enough to work together. The Clarks, the Winslows and the Italians all have children in the schools, and, with the right kind of lessons, they may all be interested in the work, especially if it is made a kind of community game to see who first can make his home flyless.

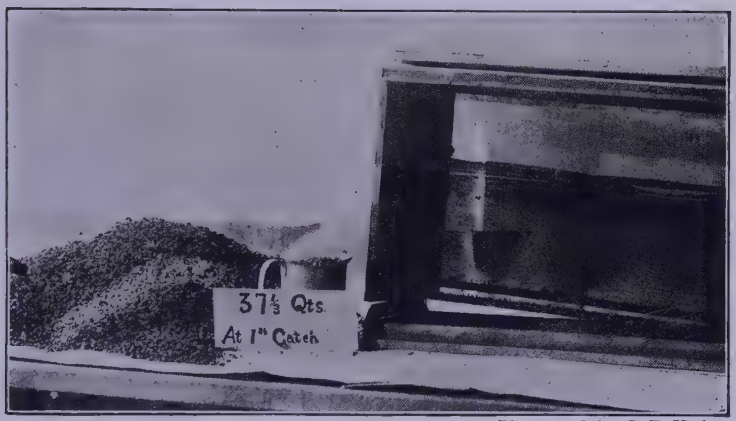
But across the street the Johnsons are saying: "Tommy-rot! We have no time or money to spend on such foolishness. We always have had flies and we always will. It can't be done. Might as well try to catch all the winds. Besides, God made flies for some good purpose; if we kill them all off, something worse will get us. Anyway, if they are as dangerous as they say, we will not allow our children to have anything to do with such work. Let the board of health and the police attend to the flies."

The above illustrates some of the difficulties in the way of securing community-wide coöperation, and suggests the following questions, which may profitably be given to the pupils to discuss and answer:

(a) How could the board of health and the police do it? How often would they have to visit each house? How many officers would it require to do this? What would it cost? Who would pay for it? How much would taxes be increased?

(b) How much less would it cost if each family did the work on its own premises? How can we reach homes in which the people can not understand our language? How can we reach families who refuse to help and insist on feeding and breeding flies to infect the neighborhood? How do the board of health and the police handle other public nuisances? Have we any other public nuisance as dangerous as this?

6. A typhoid epidemic of 224 cases and 10 deaths was estimated to have cost the people of a city $100,000. It was believed to have had its origin in impure milk and, probably, flies. How much have filth infections, in which flies may have played a part, cost your community during the



Photograph by C. F. Hodge

A DAY'S CATCH

This trap was placed in the lightest, warmest window of the stable, where the flies were thickest, and gunny sacks were hung over the other windows to darken them. All the flies around the barnyard that tried to get in or out were caught.

Photograph by C. F. Hodge

A SEASON'S CATCH

16,267,088 dead flies, the catch in the 1911 Worcester, Mass., fly campaign. Prizes aggregating $650 were offered to the boys and girls who caught the most. This shows the wrong way to manage a fly campaign, for the boy who won the first prize of $100 raised more flies than he caught.

past year? How much would it cost to exterminate the flies? How can we be sure as to what is causing much of our disease until we have cleaned up the flies? Compare the number of cases and deaths from typhoid, enteritis (cholera morbus), summer complaint (dysentery), tuberculosis, hookworm, spinal meningitis, infantile paralysis and any other filth infection common in the city, town or neighborhood, for a series of ten or twenty years back. Are conditions growing better or worse? If your locality has cleaned up and exterminated the flies in really community-wide fashion, including markets, provision stores, hotels and restaurants, milk depots and farms, especially those that produce milk, cheese and butter, what has been the result on your vital statistics?

Contains over 10,000 stable flies caught by the author's son over his cow in one day. If they had not been caught, they would have taken nearly a pint of blood. The boy had to stand and sweep around the cow with an insect net. Now that we know that the germs of infantile paralysis are carried by the stable fly, we must rid our homes and stables of this dangerous pest.

7. The method to be employed is to get the fight out-doors where it belongs. We will suppose that everybody is convinced and ready to do his part. We have said when a community reaches this point of civic unitedness, fly extermination is the easiest of insect problems, provided everybody knows *what* to do. The first thing to decide in this fight is where it is to take place. The flies are breeding out-of-doors. Can we ever hope to get rid of them by screening houses and fighting inside? What is the cost of screen windows and doors for a house? ($15,000,000 is the estimated annual expenditure for fly screens of the United States and Canada.) A house with screens is a good fly trap, but the pests are let out too often after they have obtained the food with which to make fly eggs. It is not much more

work, and is a good deal more sport, to catch a bushel of flies by the methods to be described than it is to catch a dozen "by hand," at any one time, especially early in the spring, when there are not many flies outside around a home. Thus, with a skillful leading of the discussions, it will not be difficult to bring a class of boys and girls to the conclusion that the "war must be carried into Africa"—into the enemy's camp, out-of-doors.

8. The next point is to know the enemy, to know something of the kinds of flies. How many pupils, or even teachers, really know a house fly when they see one and are able to distinguish it from the 13,000 other kinds of flies? From 90% to 99% of the flies found in the house are likely to be typhoid flies (*Musca domestica*). There are at least two other kinds that we must include in our war of extermination, the horn fly (*Haematobia serrata*) and the stable fly (*Stomoxys calcitrans*), the bloodthirsty pest of cattle, which, being a near cousin of the tsetse-fly of Africa, as stated, inoculates the virus of infantile paralysis with its bite. The bluebottles and flesh flies, which lay their eggs or living maggots on meat; the screw-worm fly, which deposits in wounds of living animals, or, possibly in the nostrils or ears of persons while asleep out-of-doors; the black, or deer, flies, which breed in running water, and the bot flies of the horse, cow and sheep, are all species worth studying where they abound, as are also the apple maggot fly and the root maggot fly of the garden.

The typhoid fly is readily distinguished by its relative numbers about houses and also by the fourth vein of the wing, which bends forward at a sharp "elbow" almost to join the third vein at the tip of the wing. Stable and horn flies can be collected around stables or stock; the stable fly is about the size and color of a house fly, but is provided with a sharp, piercing proboscis. The horn fly, often found clustering in masses on the horns of cows, is smaller, slender, dark and steel blue.

9. Reasons for every step in fly extermination are to be found in the life history of the fly itself. That is, in order

to be sure that we have found the easiest and best way, we must examine the whole chain and find the weakest link.

From photograph by C. F. Hodge

Stable window fly-trap in position. A cow stands close inside. Without baiting or care of any kind, this trap picked up practically all the stable flies that came to the place. It also caught the horn flies and at least one bot fly, and one morning was found filled with mosquitoes. In a stable in the woods near a spring a similar trap caught thousands of black flies which were tormenting the stock.

A fly lays its eggs in any wet, warm, decaying or fermenting matter, animal or vegetable; horse manure is preferred and human waste is next, hence, the great danger of

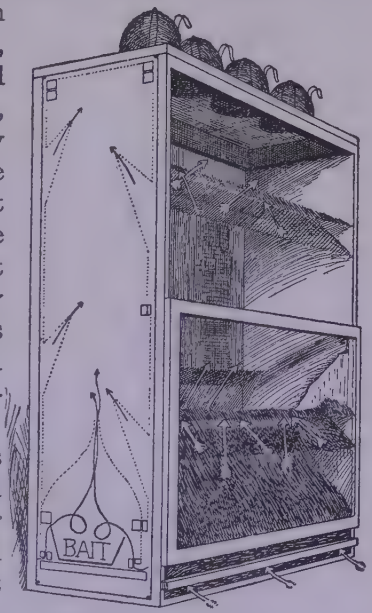
spreading all intestinal diseases; no form of earth closet can ever possibly be made sanitary; the next favored depositories for eggs is in the filth of pig pens, poultry houses, cow stables, bodies of decaying animals, fermenting garbage, weed piles, lawn clippings, decaying straw, hay or other refuse—even to the filth in spittoons. Tobacco is commonly used to kill many kinds of insects, but house flies have actually been bred out of the snuff on a druggist's counter. In cities the miles of gutters and sewers, the stables, stock yards and slaughter houses, breweries, public dumps, accidental accumulations in alleys and vacant lots, and about coal, lumber and factory yards; in the country the miles of roadsides and acres of barnyards and pastures—all these mean that breeding places and materials offer the most difficult, laborious and expensive point of attack. If there are flies about, they will always be able to find something in which to lay their eggs. Moreover, every garden needs its compost heap and every farm its cords of manure. These things in their proper places, are valuable commodities, not nuisances. Shall we permit the flies to make it impossible to use them as we need on the land?

10. With pupils of sufficient advancement discuss proper disposal of all material in which flies may breed in a home which is typical of the neighborhood. Properly handled, much of this material is valuable as fertilizer. It is of greatest value when perfectly fresh; from 55% to 65% of its strength as fertilizer is dissipated into the air by antiquated methods of "rotting." This fact has been demonstrated by the agricultural experiment stations. Secure the most recent bulletins from your nearest experiment station, and go over the ground with the class.

Proper sanitation of a farm home imposes a two-fold obligation; first, in providing a Stiles sanitary outhouse. This will absolutely prevent flies from breeding in human wastes. Of course, a water closet with septic bed or tank is equally sanitary, but is more expensive. No arrangement of dust or earth closet can possibly be worked entirely

to prevent eggs from being laid and maggots from developing in the material.

Second, to be sure that all stable manure, during warm weather, at least, is daily gathered into a spreader and immediately put under or on the ground. If plowed under, the eggs already laid in it will probably develop into flies, since Stiles has found that they will work their way to surface even though buried six feet deep. If thinly spread on the ground, in dry weather, most of it will become too quickly dried to permit the maggots developing in it. Fly eggs will not hatch if dried in hot sunshine.



Explanatory model of stable window fly-trap. There are two trap-folds on each side and an entrance also along the bottom of both sides. The arrows indicate some of the entrance holes along the trap-folds. The marks on side of trap show form of construction. (Drawn from photograph, by the author.)

For town and city schools discuss with great care and thoroughness not only proper disposal of all fly-breeding filth about the individual home, but effective organization of the work of collecting, removing and disposing of all such materials. This latter is one of the most urgent needs in the whole field. Every town or city fly campaign, with only one or two exceptions, has been thwarted by some filthy stable where people were both feeding and breeding flies by the millions. One large stable on an alley, within a block of the Lexington Market in Baltimore, when visited in July, 1910, contained a pile of manure about 40 feet in diameter at the base and 12 to 14 feet high, and just beneath the surface it was a moving, writhing, crawling mass of mag-

gots. The pile must have contained, if they could have been sifted out, not less than ten barrels of maggots. Shall such a thing as this be permitted to vitiate the best efforts of many people, scatter filth and disease in thousands of homes and over the food supplies of several hundred thousand people?

Let the class investigate the method of garbage and filth disposal in local use and decide whether it is efficient in preventing the breeding of flies. If not, in what way could it be made so? Consult your board of health about the problem and ask its most active member to visit the class and discuss its solution. Try to find out how the people of the city, especially the school children, can coöperate with the board of health in having the work most effectively done.

Along with regular collection of garbage and rubbish, every city needs a system of manure disposal which shall not allow accumulations anywhere for more than seven days, during the months from April to November. Garbage disposal has been made a self-supporting, or even a paying department of public service in some cities. By proper organization there is no reason why the handling of stable fertilizer should not only be made to pay for the work but pay stablekeepers as much, or even more, than they receive from private parties, who can not be depended upon to remove the accumulation regularly. Definite circuits with teams or autotrucks could be arranged so that small or partial loads would not require unnecessary traveling, and delivery could be all contracted and planned for, to avoid handling twice. Every citizen could file orders for the amount of fertilizer he requires for lawn or garden, stating when delivery was desired, and in this way small amounts could be distributed most economically on regular delivery circuits. Children's gardens everywhere, vacant lot gardens, suburban homes and truck gardens and all public gardens and parks could be adequately supplied probably at much less cost than by irregular private service. Civic organization

of this work may thus not only minimize breeding places for flies in cities, but result in improving the land as well.

11. The rapidity with which flies multiply is not generally known. A pair of flies may produce from 120 to 150 eggs at a laying and may live to lay at least six batches of eggs, at intervals of eight to ten days. The eggs hatch in a few hours (eight to twelve) in warm weather, grow as maggots for six or seven days, crawl into the ground under the manure, or into the cooler portions of the pile to pupate, remaining as pupae about three days, and thus complete the cycle from egg to adult in about ten days. If we start out with a pair of flies May 1st, how many flies will we have by the middle of the summer, supposing the young flies are half females and these begin to lay eggs when ten days of age? Let each member of the class figure this out, or verify the following figures:

May	10	the	number	will	be	152
"	20	"	"	"	"	302
"	30	"	"	"	"	11,702
June	10	"	"	"	"	34,302
"	20	"	"	"	"	911,952
"	30	"	"	"	"	6,484,702
July	10	"	"	"	"	...72,280,800
"	20	"	"	"	"	..325,633,300
"	30	"	"	"	"	5,746,670,500

This last figure means about 143,675 bushels of flies from one pair in three months. Any pupil who is fond of figures may continue the breeding through August and September. One man has done this (in *World's Work*, for May, 1912) and the result he reaches as the theoretical increase of a pair of flies for a season is:

1,096,181,249,310,720,000,000,000,000 flies.

Why not put that pair of flies out of business in May? Can anyone suggest a more common-sense solution of our problem?

12. In or near the tropics flies breed throughout the year; in warm places, heated basements, bakeries, kitchens, etc.,

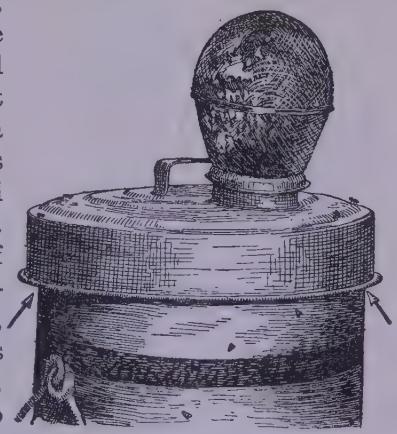
they may do so the year round, in any latitude. In all the northern United States and Canada, however, very few flies survive the winter. These, so far as we know, are young adults which find shelter in crevices about buildings, cracks in lumber piles and similar places. They emerge from winter quarters with the advent of warm weather and begin to feed, preparatory to laying eggs. Naturally, they are ravenously hungry and if every family had its flytraps set and well baited at this time, it would be easy to catch every fly before it began to lay; then the whole fight would be over almost before a community realized that hostilities had begun. The city which realizes that over 143,000 bushels of flies may result from one pair of flies in half a season, should take courage in the knowledge that the community may be flyless within two weeks after beginning the fight in the spring; further, that it will remain so as long as this level of civic intelligence is maintained.

13. A fly feeds for two weeks before laying the first batch of eggs. This is one of the most important facts to know; a fly must feed actively for about fourteen days (at least ten days) before it can mature its first eggs. This delivers the enemy into our hands. With everything most attractive to flies carefully collected into one place, the garbage pail, and over this a trap which picks them up as fast as they come, we have a vacuum cleaner of the air for flies. With every home equipped in this way, every fly would catch itself as soon as it began to feed, no eggs would be laid and the last fly to hatch out of the barnyard, or to emerge from winter quarters, would be the tail end of the procession into the exterminators.

To get everybody to believe that the plan will work, and to have faith enough in it to really stick to it, to the last fly, for ten days or two weeks, is the main thing in a fly campaign. It is, of course, best to "begin early," for "One pair in April or May means millions in August"; but in one instance it was put into operation in midsummer, with flybreeding in full blast, on a Maryland farm and

country place, where extermination proved, as one who tried it wrote, "So simple as to be almost humorous and so effective as to be little short of the uncanny." This last refers to the sudden disappearance of flies at the end of the ten-day period required for eggs already laid to emerge as adult insects.

One out-door exterminator, in the cover of the garbage can, with everything most attractive to flies carefully and immediately put under it, kept a suburban home so completely free that breakfast, dinner and supper could be enjoyed on an unscreened porch without a single fly at the table for five days at a stretch—and this, when flies were thick in the city and around other near-by homes. It is simply a question of letting the flies catch themselves as fast as they come, all day long, early mornings and long, hot afternoons, when the kitchen offers no attractions; remember, you have to catch a fly but once. If none feed and go back to the stable to lay, they disappear like magic. Any home can do this, and as soon as it is done in every home, the filth-disease fly problem will be a horror of the past, along with the great plagues, smallpox and the black death.



First model of exterminator for experimental purposes. The arrows indicate where the flies may enter. This trap caught 2,500 flies in 55 minutes; it caught 16,000 flies the first day it was used.

14. Study carefully the illustrations of devices shown in this lesson; experiment with any other devices that may have proved effective locally, and try to invent better traps to catch all flies about kitchen and stable windows.

In order to insure getting the last fly about a house, we need effective weapons. It is the fly that you can not

reach on the ceiling that escapes to lay eggs to keep up the fight. No one who has not used one can realize how easy it is to get all the flies in a house with a two, three or even four-foot swatter, with which one can reach the ceiling without stretching, and the floor without stooping. Swatters are objectionable because they injure furniture and soil walls or ceilings, and, besides, it is necessary to pick up the dead or leave them to be swept up later. The nets

"OUT-DOOR FLY EXTERMINATOR"

Final form adopted for manufacture by the National Manufacturing Co., Worcester, Mass. 1, trap complete with its own bait box; 2, trap showing metal ring for attachment to garbage can cover; 3, trap attached. The Republic Metalware Co. of Buffalo, N. Y., on special request of Dr. Hodge, have arranged to stamp out the can covers with all holes cut and punched ready for attachment to the exterminators. This will make it all simple and easy and eventually convert every garbage can and swill barrel into a vacuum cleaner for flies.

shown in the illustration are free from these objections, and a neat little hand device known as the "I-Got-Him-Fly-Catcher" is on the market, which catches the flies in a cone of tanglefoot paper. It is to be hoped that this will allay the fears of parents who object to allowing their children to help in fly campaigns, since they will not need to handle or even touch the flies in any way.

15. Working together to make the world better is the most inspiring thing in life. Suppose all the school boys and girls set to work next spring to see who first can have his home completely clean of filthy flies. How quickly we

could have a whole country of clean and healthful homes! Many communities are doing just this. Why not all? Then our country will be the first to be free from the time-old pest, the House Fly—Disease Carrier.

Lessons on the Mosquito

1. For ages everybody has been breeding mosquitoes, because nobody knew any better. Now that we have learned how to get rid of the pests, everyone should be careful to do his part for the comfort and safety of himself and others. No member of the community has any right to breed mosquitoes to suck the blood of his neighbors. Along with flies, fleas, lice and bedbugs, mosquitoes do no human good in the world. They cause great discomfort, annoyance and pain by sucking the blood of men and animals, often poisoning the skin and causing serious irritation. Certain kinds, the *anopheles*, when they bite, inject into the blood the germs of malaria (ague, chills and fever). Another kind, the "yellow fever mosquito," *Aedes calopus* (formerly named *Stegomyia fasciata*), carry the germs of yellow fever in a similar manner. The latter is one of the common rain-barrel and cistern mosquitoes of the tropics and of the south United States. A large part of the annual bill for screen windows and doors, $15,000,000, is chargeable to presence of these pests, and the bills for malaria and yellow fever and depreciation of real estate, due to them, run up many millions more. In all these ways in the past the swarms of mosquitoes have driven man before them from the places they infest. Now we have discovered ways and means of completely banishing these ancient and blood-thirsty enemies of mankind. How can we do this?

2. To be able to conquer an enemy we must first know about his ways of doing things, his plans and methods of working. The first thing we learn about mosquitoes is that they do not fly far. Except for a few migratory kinds that breed in the salt marshes along sea coasts, our common mos-

quitoes seldom fly more than two or three hundred feet from the places where they breed. Next we learn that mosquitoes all breed in stagnant or slowly flowing water, in which fishes can not, or do not, live—rain-barrels, cisterns, watering troughs, tin cans or bottles, gutter, roadside and barnyard pools, cow steps in bogs and in pockets, holes or patches of weeds in and about the margins of ponds, lakes or streams. Hence, the first thing to do is to drain or fill all undesirable water holes and scrape clean of weeds, stumps or rubbish, and grade the shores of all streams and ponds, so that, as they rise and fall, no mosquito breeding pockets will be left. Any water which can not be drained or filled or stocked with

"CULEX PIPIENS," MALE AND FEMALE
Female at left

fishes should be covered with crude petroleum or kerosene oil, one ounce (a tablespoonful) to fifteen square feet of surface.

3. The eggs of many common rain-barrel mosquitoes may be readily seen in the form of "rafts," each containing from 200 to 500 eggs—the laying of a single mosquito—stuck together on end and floating on the surface. They are usually laid very early in the morning and generally hatch a little after noon of the same day. *Anopheles* mosquitoes scatter their eggs singly on the surface of the water and they float until they hatch. They are harder to find in the open, but may always be obtained by confining well-fed *anopheles* in an aquarium—a tumbler is large enough. The yellow fever mosquito also scatters her eggs singly, but they sink to the bottom as laid.

4. Young mosquitoes do not look as much like their mothers as little chickens look like hens. Indeed, this is true of most insect larvae. Butterfly and moth eggs hatch into worm-like caterpillars; eggs of bees, ants and flies, into maggots; those of beetles, into grubs; so that it is not strange that mosquito eggs hatch into "wrigglers" in the water.

PUPAE OF MOSQUITOES

Larval skin still clinging to one at left. (From photograph from life, by the author.)

5. As we study the wrigglers, we see that they grow very fast—which means that they find food in the water too small for our eyes to see—and in about seven days shed their skins and change into quite different looking wrigglers. They are known as *pupae* and correspond to the chrysalides of moths and butterflies. In this stage the insect has no mouth and does not feed, but spends its time breathing quietly at the surface of the water while it is very busy inside tearing down its wriggler organs and making them over into eyes, feelers, proboscis, wings and legs for the real mosquito which comes out of the water at the end of about three days. Thus, we find that a mosquito may grow from an egg in about ten days. When we realize that a mosquito lays from 200 to 500 eggs, we can readily see how mosquitoes become pests.

6. These lessons are intended only for localities where mosquitoes are pests, or where they would be, if not properly attended to. In general, we should plan to have two or three good, pointed lessons as soon after school begins in the fall as possible, when the pests are at their worst, or the memories of their torments are fresh, and specimens in all stages are abundant. Interest started then will give time to mature plans for the real campaign in the spring. Later in the fall, or at any time during the winter, a lesson on hibernation may keep interest alive and be of great practical value. At this time search with a lantern in dark, damp, corners of house and stable cellars is likely to prove a revelation. Hundreds or thousands of mosquitoes may be seen clinging to

walls and ceilings, waiting for spring, when they will begin to suck blood and lay the eggs that will produce the summer's swarms. The early spring pools are likely to be swarming with wrigglers, and the main lessons should be timed to prevent these from emerging from the water.

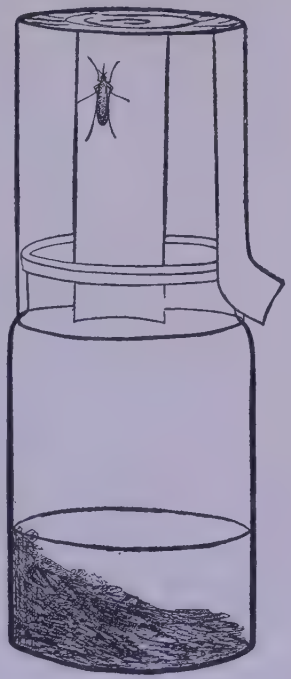
BOTTLE FOR CATCHING MOSQUITOES

7. In beginning the lessons the teacher may collect a few specimens, or, better, ask some interested pupils to bring in all the different kinds of mosquitoes they can find, with eggs and wrigglers, so that the whole class can see exactly what they are to look for. The specimens can be kept in tumblers or bottles with netting over the tops. After the pupils have studied them so that they will be sure to distinguish mosquitoes from gnats or crane flies and have gone over the life history, including the possible diseases and annoyance caused by them in the district, each child should be encouraged to contribute all it can toward developing a plan of campaign which shall make extermination possible. The chief object is to develop interest and power in the children themselves to study and work out such problems.

8. Clearly the first thing to do is to have the pupils hunt over their own home premises for breeding places, and all should coöperate, being careful to get permission in doing the same for neighbors who do not have children in the school. It might be well to unite in making a map of the breeding places in the district. In carrying on this survey

each will do his best to clean up every breeding place found about his own home, and will report what he has done, with the result to the school.

It will often be discovered that some trifling bit of carelessness is filling the neighborhood with mosquitoes. In one case a furnace ash pan, set outside of a cellar window, was found green with algae and alive with *anopheles* wrigglers. Probably several cases of malaria, near by, had already been caused by the mosquitoes which were hatched out of it. A cistern, where a house had burned, filled another district with a plague of mosquitoes. A rain barrel, the water barrels on railroad bridges, a clogged roof gutter, a big hole in a hollow tree containing nearly a barrel of water, a hole among the rocks in a quarry, were each found responsible for a similar plague. All such could be emptied or treated with kerosene, to the great relief of homes in the neighborhood. In one case the magnificent water lily and lotus ponds in a park filled the place so full of mosquitoes that people could scarcely walk through it. Some boys, when they learned what to do, easily caught minnows from a brook near by, put them in the ponds, and had the park free from mosquitoes in a few days. It was fun for the boys; it saved a beautiful feature of the park and made unnecessary the expense of filling the ponds, and restored the park to the enjoyment of thousands of people. Many things are so easy, if we only know how.



JAM BOTTLE AND TUMBLER ARRANGED TO OBTAIN MOSQUITO EGGS

Large dumps with stagnant pools here and there, swamps or bogs and weedy brook channels, may be covered by excursions, in which each pupil carries his own can or bottle of oil, hoe or garden rake; thus many hands may make light work of the more difficult propositions. This temporary work will naturally become the basis for solid, permanent improvements in cities, towns or country neighborhoods.

9. The case of Beaver Brook, in Worcester, Mass., is a good illustration in point. This brook winds for nearly two miles through the residence section. As the city grew, the low places in the valley were made dumps for rubbish and the brook itself was carelessly dammed up by these accumulations. Fine groves along the brook valley were killed by being flooded and were converted into festering swamps, which bred mosquitoes of both the malarial and common forms, enough at certain seasons to render the region well-nigh uninhabitable. The illustration shows the children of Downing Street School on a nature excursion, under careful direction cleaning up and oiling all the pools along both sides of the brook channel, wherever mosquitoes were found breeding. The excursion was well timed, about the first of May, when the pools were black with mosquito pupae just ready to come out of the water; and the work was so well done that for the first time in years the people could enjoy their gardens and porches at that season without being molested. The city was not slow in demanding permanent relief; a strip of land was taken for a wide street, and in it the entire brook channel was laid in cement. An ornamental drive is planned to connect two large parks and thus a public nuisance is being transformed into a great and permanent improvement.

10. Many people in your neighborhood may claim it is not possible to rid the district of mosquitoes by treating the stagnant water, because they breed in weeds, grass, damp earth, the vines about the houses, in the trees, or even in the air.

Take about a hundred wrigglers, lay them on blotting paper, let them dry in the air for a day, put them in water—

EXTERMINATING MOSQUITOES

Photograph by C. F. Hodge

paper and all—and see if they come to life. Do the same, using mud, grass or leaves, in place of the paper.

Place in an aquarium or fish globe, a small fish, preferably a young sunfish, bass, perch, trout, pickerel or other native species, and keep it there until it is at home; then put in a few hundred or thousand wrigglers. Let each member of the class try to count how many the fish takes for a meal. Repeat the experiment using, instead, a newt, salamander or young turtle. Will the results explain why wrigglers are thick in some pools and not in others? Make as complete a list as possible of the enemies of mosquitoes in the water.

As opportunity presents itself, direct the pupils to study the work of birds in destroying mosquitoes in the air. In a feeding test a bob-white chick ate 568 mosquitoes in two hours. Swallows, swifts, flycatchers and many other birds, as well as bats, toads and even dragonflies, help to hold mosquitoes in check.

Finally, to impress the need of careful, thorough work, ask for volunteers to count a good-sized raft of mosquito eggs. This may easily be done by turning the raft wrong side up on the tip of the finger and counting the rows of eggs with a magnifying glass. Take the average of the counts, or the nearest even hundred and have the class figure how many mosquitoes might be produced from a single pair in one month, three months, six months, allowing ten days for a generation and supposing that one-half are females. It will add to the interest if each pupil makes the count independently and writes the result on a slip of paper, none of the results being announced until all have finished counting.

This lesson will serve to show the power of insects, if they once get the start of us and if we give them a chance to multiply.

Bird Studies

By becoming acquainted with the life history and haunts of a number of common birds, the teacher can create an interest in their study through descriptions given in the form of stories. The color plate here presented is designed to assist the teacher in making this preparation and also to give the pupils a good idea of the appearance of these birds. The teacher should weave the facts here given into interesting stories.

(1) The Indigo Bunting. This beautiful bird is common over the United States east of the Mississippi River and throughout Ontario, the southern part of Quebec, New Brunswick and Nova Scotia. It is occasionally found in the states between the Mississippi River and the Rocky Mountains. It spends its winters in Central America, the northern part of South America and Cuba. It begins its migration northward early in the spring and reaches the latitude of the Ohio River about the middle of April, and points farther north a little later. It is frequently found in the southern states, where it nests, but it is not as common in these states as in the region farther north.

The bird is about five and one-half inches long. The color of the male is a rich blue, deeper on the head and brighter on the back. There are black markings on the wings and tail. The female closely resembles a sparrow but has a glint of blue on the shoulders and tail.

The nest is hidden in the foliage or shrubbery and skillfully concealed. It is usually located in the upright crotch of a shrub or low tree and is made of grass, dead leaves and strips of bark, and lined with fine grass, roots or hair. Three or four pale bluish-white eggs are laid.

The bunting's food consists chiefly of insects, worms, caterpillars and grasshoppers, of which it is particularly fond. It also eats some seeds and may be reared in a cage on the same food as the canary. Although shy, the bunting is one of our most interesting and lovable birds. The garden is its favorite haunt, and it is found in much larger numbers around our homes than in the deep forest. The cheerful song of the male is heard throughout the long, hot summer day, as, perched upon the high bough of a tree, he overlooks the surrounding region, ready to warn his mate of approaching danger.

In looking about gardens, hedges, old pastures and wayside shrubbery you may occasionally discover a nest like the one described, carefully hidden away. If you do, take the greatest care not to disturb it or the occupants may desert it. If unmolested, buntings frequently return to the same nesting place year after year.

(2) Baltimore Oriole. On a bright May morning your attention may be attracted by a clear, melodious whistle from the vicinity of a near-by tree top. As you glance upward, you may be awarded by a vision of brilliant colors—orange, yellow, black and white—darting

Painted expressly for Public School Methods

OUR FRIENDS THE BIRDS

Indigo Bunting
Sandpiper
Blackburnian Warbler
Cowbird
Scarlet Tanager
White-eyed Vireo
Goldfinch
Woodpecker

in and out among the foliage. Then the object perches upon a bough, and you behold one of the most beautiful birds you can imagine. The head, neck, throat, back, wings and the greater part of the tail are black. The wing feathers are tipped with white. The other parts of the bird are orange. You will probably exclaim, "Oh, the oriole has come," or "The golden robin is here," or "Look at the fire bird," or "See the hangbird," for all these names are applied to this brilliant visitor.

The Baltimore oriole is a little smaller than the robin. It is found in all North America east of the Rocky Mountains, south of the central part of Alberta, Saskatchewan and Manitoba and north of Texas. It also occurs in small numbers in western Montana and Wyoming. It winters in the southern part of Mexico and southward as far as Columbia.

The brilliant male starts upon his journey northward before the female and arrives several days ahead of his mate. He is a vain fellow and calls attention to his bright colors by whistling loudly as he darts through the tree tops. His movements are not capricious, for he is in pursuit of insects, upon which he feeds.

The nest is usually hung from the extremity of a branch forty or fifty feet from the ground. It is shaped like an old-fashioned knit purse and is about seven inches deep. The structure is made of grass, string, horsehair and other material, all marvelously interwoven so as to form a strong pouch, in which from four to six white eggs, splotched with brown, are laid. The nest is the work of the mother bird alone; the male shows his interest by standing around and looking on.

The Baltimore oriole feeds upon insects and worms which destroy crops and the foliage of shade and fruit trees, therefore he is one of the farmer's best friends and should be carefully protected.

Ask the pupils to make a note of the number of orioles they see. If they can locate a nest, it will be interesting for them to watch the birds, but they must not try to get at the nest. Olive Thorne Miller calls young orioles the "cry-babies of the bird world" because of their ceaseless call for food.

(3) Cowbird. You may have noticed flocks of brownish-black birds following cattle that are grazing. Because of this habit these birds are known as cowbirds. The cowbird is a cousin of the blackbird, which it closely resembles in size and appearance. It follows the cattle because it feeds upon insects which the cattle disturb when grazing.

The cowbird is not a general favorite because of its peculiar nesting habits. It makes no nest of its own, but lays its eggs in the nests of other and usually smaller birds, such as the thrush and the vireo, depositing the egg when the owner of the nest is absent. The egg is

not laid, however, until one or more eggs have been laid by the owner of the nest, so that the deception will not be noticed. The cowbird's egg is larger than the others and covered with brown spots. It hatches before the other eggs and the young cowbird gets most of the food brought to the other young birds. It grows rapidly and when strong enough it frequently throws the other young birds out of the nest. Strange as it may seem, this deception is seldom noticed by the foster parents, who rear the young cowbird as though it were their own. But as soon as this bird leaves the nest, it seeks its own kind and remains with them. To make up for the possible loss of its eggs, the cowbird lays ten or twelve, sometimes more.

During the summer, the cowbird feeds upon grasshoppers and other leaf-eating insects, and in the spring and fall it eats seeds of weeds and some grain. It is estimated that about seventy per cent of its food consists of seeds, but since most of these are seeds of plants injurious to the farmer, the cowbird should be reckoned among the farmer's friends. Moreover, since this bird has no permanent home, it is free to go wherever destructive insects are the most numerous, and these birds are sometimes considered as the "unattached light squadrons of the insect destroyers." On the other hand, it is estimated that the life of at least two birds is sacrificed for every cowbird that is reared. It is therefore doubtful whether or not this bird is of any real benefit.

(4) GOLDFINCH. Some morning a pupil may tell you, "I saw a wild canary bird perched on a thistle blossom this morning. It had a black cap and black wings and tail, but its body was as yellow as gold. When the little fellow saw me he flew away singing, *pr-chic-o-reê, pr-chic-o-reê.*" "Oh, that was a yellowbird," says one; "No, it was a thistle bird," says another. Unless you know the real name of this bird you may be puzzled by the number of names that the children have applied to it. However, each child is right, for all these local names are common and in many localities they are heard more frequently than the correct name, *goldfinch*, by which the bird is everywhere known. The female is olive-brown above and paler or yellowish below, and without the cap on the forehead.

This little bird is one of the most charming of our feathered friends and it remains with us throughout the year, the male changing his coat for fall and winter so that it resembles that of his mate. Except during the nesting season, which occurs late, these birds are found in small flocks about gardens and in fields, where they feed upon seeds. They prize especially the seed of the thistle, the dandelion and the sunflower, and the best way to keep them about the premises during the winter is to plant sunflowers and leave them without harvesting the seeds. The nest is a dainty cup-shaped affair built in the fork of a tree or branch from six to thirty feet from the ground. It is usually lined

with thistle down, and the fondness of these birds for the thistle readily explains how they obtained the name *thistle bird*. The goldfinch's song resembles that of the canary. The birds are easily tamed, but they seldom sing as well in captivity. The goldfinch is common throughout the southern part of the Canadian provinces, and the United States east of the Rocky Mountains to the Gulf of Mexico.

(5) Scarlet Tanager. Someone says that the flight of this bird through the trees is "like a brand plucked from tropical flame." Be that as it may, the tanager closely resembles a tropical bird because of its gorgeous coloring. The wings and tail of the male are black and the body is a bright red. The female is greenish above, yellowish below, with wings and tail darker and tinged with brown. The nest is on the horizontal branch of a tree at least twenty feet from the ground. The eggs, three or four in number, are bluish-white or greenish-blue with occasional brownish markings. The tanager is a little smaller than the robin. This bird is considered rare because it haunts the deep hard-wood forests and passes most of its time there in the tops of the trees, where it is hidden from view by the foliage. It is, however, common in Canada and the United States east of the Rocky Mountains, spending the summer in these regions and the winter in the northern part of South America. Tanagers prefer the oak to any other tree, but in spring they are often seen in orchards and around buildings. Sometimes they even follow the plow like the robin and the blackbird, in search of worms. They feed upon insects that are injurious to trees, and render great service in the preservation of hard-wood shade and timber trees.

(6) Woodpecker. Your early-morning nap may have been disturbed by the rat-a-tat-tat of the woodpecker as he drilled a hole in the trunk of a near-by tree in quest of a good fat borer for his breakfast. There he is with his red cap and black and white coat clinging to the trunk of an old tree, and industriously drilling away in his pursuit of the worm. His home is in the trunk of an old hollow tree and here the mother bird lays from four to six glossy white eggs. Woodpeckers are found wherever trees grow the world over, except in Australia. There are thirty-five different species in the United States. They go south in winter, where they become very numerous in the Southern States.

In drilling, the woodpecker draws back his head and body as far as possible and strikes the tree with all his force, sending his strong bill, which is chisel-shaped, into the wood. The skull is thick and hard, made to withstand the jar from his continuous hammering. The bird has a spear-shaped tongue with barbs on the tip, pointing inward. When the hole has been drilled to his prey, the bird darts his sharp tongue out beyond the bill, pierces the worm, and draws it into his mouth.

Woodpeckers do much towards preserving the forests by their destruction of numerous insects known as *borers*, because their larvae bore through the wood in the tree trunks.

(7) SANDPIPER. The sandpiper is an interesting beach or shore bird and is frequently met with around ponds and lakes, where it wades in shallow water in search of food. Its nest is shallow and built in weeds or rushes or on the shore near the water. The eggs, four in number, are of a creamy color, spotted with brown, and much larger at one end than at the other. This shape is characteristic of the eggs of all birds which make shallow nests. These eggs will roll around in a circle and not get out of the nest if disturbed. Birds that build deep nests usually lay an egg nearly oval, since the shape of the nest is such that the eggs cannot roll out. (See Celia Thaxter's poem, *The Sandpiper*, Volume I, page 454.)

PLANS FOR TEACHING NATURE STUDY

MAME ESTELLE MYERS

FIRST YEAR

Introductory Note: Since all teachers cannot secure the same material to use in nature study, a variety of subjects has been suggested in these plans so that each teacher may be able to select material appropriate for her school. Outlines on any of the plants given may be applied to other plants common to the localities of different schools. The same is true of the plans for the study of animals. Subjects familiar to the pupils and interesting to them should be selected for study.

Refer constantly to the chapter *Nature Study.* It contains an abundance of material and ample directions for carrying out the plans successfully.

SEPTEMBER

1. First Week. Make a study of the morning glory, nasturtium or any large flower in which the parts can be easily seen. Call the pupils' attention to the roots, the stem, the shape of the leaves and to the flower. Note the little green cup that holds it, the number of parts to it, the colored corolla and the number of parts it has. Note the yellow center. Examine the seeds, if there are any. Speak of the use of each part of the plant.

2. Second Week. Study grasshoppers and crickets. Have a few in wire cages. Let the pupils feed the insects every day. Let them discover how many parts their bodies have, how many legs they have, how many wings and how they sing.

Study caterpillars. Let the pupils collect, feed and watch the changes that occur. If any occur in school hours, all work should be laid aside in order that they may discover some of Mother Nature's most wonderful secrets, a knowledge of which will give the children more satisfaction than anything learned in books. Cocoons should be placed out-of-doors so that the butterflies may not develop too early in the spring. Let the children note the covering of the caterpillar if it has any, the parts of its body and what it feeds upon. Note all peculiar characteristics.

3. Third Week. Study a dog. Have one at school to study, if possible. Let the pupils observe dogs at home and report what they learn about him and his habits. Lead the children to describe the parts of the dog; his head, neck, body, legs and tail. Speak of his warm

coat, his large ears, his eyes and large mouth. Have the pupils notice his long tongue and sharp teeth. How does he eat? What does he eat? The teacher should explain how dogs should be fed to keep them in good condition. (See page 81.) Has the dog a keen sense of smell? How do we know? Study his feet. How does he lie down? How and where does he sleep? Notice what he does when he is listening intently. Can he hear well? How do we know when he is glad or sad? How does he seem to talk? Is he useful? How? Do children like dogs?

4. Fourth Week. Study a cat in the same way as the dog. Develop the fact that the cat can see in the dark, and lead the children to tell why this is necessary. Notice her rough tongue. Explain why it is so. Discuss her teeth and her sharp claws. Let the children explain that she needs these to assist in catching mice and in defending herself. Study her feet. Note the cushions and the way she sheaths her claws. Of what use are the cushions? What does the cat eat? Drink? How does she drink? Let the children watch her do this. Is she useful?

OCTOBER

5. First Week. Make a study of fruit. Choose fruit common to the locality. An apple, a peach, a pear or grapes may be used, or if all of them can be obtained, one may be studied in detail and the others compared with it.

If there is an orchard near, take the pupils to visit it. Note the chief characteristics of the apple tree; its height, the low branches, the leaning trunk, the bark, the oval leaves, the pretty fruit. Study the apple. Cut one crosswise. Note the parts; the skin, the pulp, core and seeds. Let the pupils describe each part. Ask how we know when the seeds are ripe, why the apple has seeds. Then speak of the ingenious way in which the apple tree's seeds are protected. Compare the peach, pear and grape with the apple, noting that all are similar, except that the apple has a core and the peach a pit. Crack the pit to find the peach seed.

6. Second Week. Study the milkweed. Have a whole plant for the class to examine. Note the kind and number of roots, the kind of stalk, leaves and pods. See how many remember the kind of blossoms the plant has. Notice how the pods are arranged on the stem and how fastened to it. Note the texture of the outside of the pod. Then open a pod and notice the arrangement of the seeds. Notice the inside of the pod and compare it with the outside in texture. Study in a similar way any common weeds that have large seeds or burrs.

7. Third Week. Have a collection of seeds used as foods (grains, peas, beans and nuts). If possible, gather the stalks with the seeds so the pupils can see the seed cups. Lead the pupils to see how most

seeds grow in families, as peas, beans and grains. Note the kind of cradles the seeds have. Are they like the milkweed's? Let the class tell how Mother Nature protects many seeds (by spines, thorns, etc.).

Examine grains. Note those that are similar in appearance. Note their hard, rather rough coats. Ask how the grains are prepared for us to eat. Show cups of flour, corn meal, graham and oatmeal. Explain how the grains are ground and how the wheat flour is sifted. Have the children tell, if they can, what mother makes of the different meals.

Compare beans and peas as to shape, surface and manner of growth. Name seeds or grains eaten by animals.

Study the native nuts; how they grow, when ripe and how cared for after they are picked. Why are many of them protected by thick husks and hard shells?

8. Fourth Week. Study autumn leaves. Collect branches of maples, oaks and sumacs. Note the shape and color of the leaves. Compare different maple leaves, then compare them with oaks. Note what trees have lost most of their leaves, and what trees have lost but few.

NOVEMBER

9. First Week. Subject for study: *Preparation for Winter.*

(a) By People. They store grain, vegetables and fuel. They bank their cellars, put on storm doors and windows. They put on warmer clothing.

(b) By Birds. They migrate south. Many change their plumage.

(c) By Animals. They put on heavier coats. Some curl up in caves for the winter. (See page 49.) Some store food, as the squirrel. (See page 84.) Insects likewise gather and store food, as the bee and ant.

(d) By Plants. They ripen seed. They drop their leaves. Some die. Trees develop buds. Their sap returns to the roots.

10. Second Week. Study the deer. Have good pictures for the class to look at, such as *On the Alert*, Bonheur; *The Monarch of the Glen*, *Red Deer of Chillingham*, *The Deer Pass* or *The Deer Family*, Landseer. (See *Picture Study*, page 414.)

Call attention to the characteristics of the deer. Note the differences between the stag and the roe. Note the spots on the fawn. Tell the class of the deer's habits, what they eat and of how they protect their young. Speak of the mother deer's courage. Tell what the Indians used deer skins for.

11. Third Week. Make a study of some vegetable that may form part of the Thanksgiving dinner, such as a squash, sweet potato, beet, turnip or cabbage. Let the class describe it, tell what part of the plant

it is, when we plant it and when it is ready to be eaten. If the squash has been used, cut it and note the parts, how the seeds are arranged and how attached to the pulp. Describe the seeds. What other seeds do they resemble?

12. Fourth Week. If possible, have a tame squirrel to study. Let the pupils observe him for some time before the study really begins. Then speak of his covering. Note the quality of his fur and explain why it is short, thick and coarse. Study the parts of his body; head, neck, body, tail, legs and feet. Make a careful study of the squirrel's ears, eyes, mouth, teeth and feet. See how he uses his feet and his bushy tail. Study his habits; his manner of climbing, sitting, resting, eating, burying of nuts and keeping himself clean. Then discuss his home and food, and tell the children he is easily tamed, and can be coaxed to feed from one's hand.

DECEMBER

13. First Week. Study an evergreen common to the neighborhood. Note where it grows, in what kind of soil. Observe its general characteristics. Then study the twigs. What kind of needles has it? How are they arranged on the stem? What kind of cones has the tree? Of what use are they? If cones can be found that have not opened, show the pupils where the seeds are. What is this tree used for?

14. Second Week. Make a study of sheep. (See page 80.) If there are any that the children may study, take them to see the sheep. If not, have some good pictures of sheep and some wool. Let the class describe the sheep. Explain to them any characteristics of the animal not shown in the picture. Describe the mouth, teeth and feet. Tell the children what the sheep like to eat, and explain the care that must be taken of them. Tell of the sheep in Palestine.

15. Third Week. Study snowflakes, if any have fallen. Catch large ones on dark cloth and note the shapes of them. Talk about where they come from and what moves them from place to place. Of what use is snow? (See page 22.) If there is no snow, make a study of holly or mistletoe. Tell the myth concerning it.

Note the birds that are residents during the winter. See how many of these the pupils know. Select one of the familiar ones to study. Let the children find out all they can about it. Let them describe it, tell where it nests and something of its nest, if possible. See how many know what the bird eats. Tell them what it eats in winter and what keeps it warm. See if anyone knows where it stays during the night. Ask how it treats other birds. A bluejay, a nuthatch or an English sparrow would be good to begin work with. Tack feeding trays to the window sills and keep them supplied with suet, cracked nuts and crumbs. As the birds feed, the children can study them. (See *Birds*, page 51.)

JANUARY

16. First Week. Study frost. Notice its effect on hands, feet and noses, on vegetables, on water pipes, on bottles or pitchers filled with liquids, and on window panes. Fill a bottle with water and let stand on the window sill outside over night. Let the pupils note that the ice rises higher in the mouth of the bottle than the water did, and also note the effect on the bottle. (See *Snow*, page 22.)

17. Second Week. Study the sun. (See page 17.) Notice where and when it seems to rise and set. Speak of the use of the sunshine and the pleasure it gives us. If there are plants in the schoolroom, turn them around occasionally and let the pupils note the effect of the sun upon the leaves. Speak of shadows. Let the pupils discover how they are made and tell their experiences with them. Let the children note the length of their shadows in the morning, at noon and at night. When are they longest? Shortest? What color do they seem to be?

18. Third Week. Make a study of the horse. Study the animal in detail as suggested on page 73. Dwell upon its use to man and the treatment it should receive.

Study the goldfish. If there is a bowl of them in the room, study the parts of the fish, the covering, the eyes, mouth and gills, the way the fish moves and the way it breathes.

19. Fourth Week. Note the birds that are common. Study one in the manner indicated in the December plans.

FEBRUARY

20. First Week. Notice where and when the sun rises and sets, showing that it seems to travel. Note the difference in the length of day.

Let the pupils watch the change in the moon from the new crescent to the full moon. Call their attention to the fact that it does not rise at the same hour every night, and that we can sometimes see it during the day. See if the children can think why this is true.

21. Second Week. Let the children observe the stars, telling what shape they seem to be and the difference in size. Teach the pupils to recognize the Big Dipper. Perhaps the parents or older brothers and sisters can assist the pupils in locating the dipper.

Study another winter bird. At the close of the month, watch for the return of the summer birds.

22. Third Week. Study the cow. Let the pupils observe her and report their observations. Note all her prominent features. Let the pupils describe her horns, eyes, mouth, teeth, nose, neck, feet, etc. Later discuss her usefulness to man in furnishing milk, cream, butter, cheese, leather and meat. Tell the children about the old-fashioned

tallow candles made from the fat of the cow. Emphasize the fact that so good a friend should be well treated. For other suggestions see *Nature Study*, page 78.

23. Fourth Week. Make a study of the common materials of which clothing is made. Review the December lessons on the sheep. Explain briefly what must be done with wool in order to have it made into cloth. Ask when we wear wool clothing and why. Name some things made of wool. (See *Wool*, Vol. III, page 30.)

Speak of other animals that furnish something for people to wear (furs, leather, etc.).

Make a study of cotton. If possible, have seeds, cotton bolls and a miniature cotton bale for the class to examine. Let them pull a little of the cotton out to see how long the fibers are. Explain briefly how cotton is raised, picked, packed and shipped. Name things made of cotton.

MARCH

24. First Week. Let the children tell what the wind does, the pranks it plays. Ask them if any one can see the wind? How can one who is in the house tell that it is blowing? What game do children play with the wind? (Sailing kites.) (See page 25.) How does the wind help us?

Study the clouds. (See page 23.) Note the different kinds; the big, gray ones that often bring rain, the big, fluffy white ones that make banks around the horizon, the pretty pink, silver and gold clouds that appear in the early morning and at sunset, and the fine, feathery little clouds that sail away, high overhead, in the middle of the day. Tell the story of Aurora, *Round the Year in Myth and Song*, by Holbrook. Show a picture of Aurora.

25. Second Week. Study the robin; describe it. Learn its note. Observe when it returns, when it begins to build its nest, how the nest is built, where and what the robin eats, how it seems to find its food, when it seems happiest, and why we like to have it with us. Tell the children how, by being quiet and careful not to frighten the robin, one may tame it. John Burroughs had robins tame enough to eat from his hand. (See page 64.) Watch for the return of other birds.

26. Third Week. Make a study of buds. Gather pussy willows or any good sized buds, put in water and watch the development. Note the enlargement of other buds as the spring advances.

27. Fourth Week. Study Lima beans. Soak the beans so that their parts may be separated and the plantlet seen. Explain the use of the thick seed leaves. Plant some beans and watch the development.

Study peas in the same way as the beans; then plant. Note the difference in the way the two kinds of plants develop.

APRIL

28. First Week. Note the time and place where the sun seems to rise and set. Call attention to the lengthening day.

Study the development of the lilac buds, or the buds of any trees that are well advanced. Note which buds are farthest along — those at the end of twigs or those along the sides. What do these buds contain? Place them in water and note the development. Note also the way the buds have been protected.

Make a study of the bluebird. Note when first seen in the spring. Have the pupils describe it and its note. Call attention to the fact that the male has the brighter plumage. See where and how it builds its nest. Encourage children to put up boxes and birdhouses for the bluebirds. Tell the pupils what the bluebird likes to eat, and that it resembles the robin in that it likes to be near people. Speak of its enemies. What other summer birds have arrived?

29. Second Week. Recall the lesson on clouds. Ask what kind of clouds we see often this month. Then discuss April showers. Speak of the uses of rain, how it washes dust out of the air, washes the faces of plants, gives the plants a drink, makes the soil soft so the plant roots can get through it more easily, and enables the robins to catch worms more easily. Speak of the music of the rain falling on the roof. Note how it fills the brooks and rivers. (See page 20.)

Study the rainbow. Have a prism (a glass pendant from an old hanging lamp is good); hold it in the light and let the pupils note the colors. Let them tell what the colors remind them of. (The rainbow.) Ask them when we see rainbows. (Usually after a storm, sometimes during one, when the sun tries to drive away the clouds.) Explain that the sun strikes the raindrops in the air and makes these colors. Let the pupils tell what the rainbow means. If they do not know, tell the Bible story of the flood and of the beautiful bow of promise afterwards placed in the sky. (See Vol. I, page 339.)

30. Third Week. Watch for the first spring flowers. Secure one of the plants that blossoms early, to study. This may be a hepatica plant. Let the pupils study the parts. Let them note the kind of roots it has, tell of what use they are, the kind of buds and flowers it has and the kind of leaves. Note when the leaves appear. Tell why we like this little flower. Put the plant in a protected spot in the ground with plenty of leaf mold around the roots, when the class are through studying it. It will grow and be pretty another year.

31. Fourth Week. Study the dandelion plant. Obtain a dandelion plant, root and all. Let the pupils study the root, the shape of it, the length, and in pulling one, each can test its strength. Let them tell the use of the roots. Notice the growth of the plant. The leaves and blossoms form a sort of rosette. Note the length and shape of the

leaves. Let the pupils describe the blossom. Let them tell what they like to do with them. (Make curls and chains of the stems.) What color is the juice of the dandelion? How does it taste? Why do we like the brave little dandelion?

Study a dandelion that has gone to seed. Let the pupils look at the round, white fluffy balls. Let each child pull out a seed and look at it. Ask why it has wings. What will happen to the tiny seed? Let the children blow the seeds and notice how they sail away. (See Vol. I, pages, 56-57.)

MAY

32. First Week. If poplar trees are common, make a study of them. Call the pupils' attention to the shape of the trees, to the way they hold their branches, to the kind of bark they have, and to the leaves. Have twigs for the pupils to examine at their seats. Note the shape of the leaves, the kind of edges, and their arrangement on the stem.

Study the woodpecker. Have a good colored picture of a redheaded woodpecker. Let the children tell what they know about him. (See color plate, page 128.) Call attention to his long, stout bill, his short tail and its use, his feet, the number and the arrangement of his toes. Let them tell how he builds his nest. Tell what the woodpecker eats, why the trees like him and why we should be good to him.

33. Second Week. Make a study of a hen. Have one at school for a day or two. Let the pupils note her characteristics. Let the children feed her and observe how she eats. Notice how she uses her feet. Study the covering, noting the difference in the size and quality of the feathers on different parts of the body. In discussing her head, note the bill. Let the pupils discover how the hen breathes. Has she teeth? Can she hear? Where are her ears? Note the size and structure of her wings. Study her legs and feet. Of what use is the hen? How many eggs does she lay in a day? How should we care for her? (See page 65.)

34. Third Week. Study the toad. For material and plan for this lesson see pages 68, 69.

35. Fourth Week. Let each child have an apple blossom or some other large flower. Call attention to the little green cup that holds the blossom. Notice the dainty green stem, also. Speak of the corolla with its five fluffy petals. Notice the shape of the petals. Ask why the lower part of each one is so much smaller than the upper part. Speak of the center. Let the pupils learn for themselves that there are two parts to the center; one part consists of little powder boxes. Explain how the powder, or pollen, by falling on the little green center, helps the seeds to grow.

JUNE

36. First Week. Note where the sun rises and sets, and the time of each. Talk about the long, sunshiny days of June. See how many of the wild flowers brought in, the children know the names of.

37. Second Week. Study the crow. Note its size, color, long bill, eyes, long wings, long tail, strong legs and feet. Let the pupils describe these. Learn how the crow moves — does he hop or walk? What does he eat? Why is he often killed? Is this right? What kind of a home has he? Do crows take good care of their little ones? Tell the children any facts they cannot learn for themselves. (See page 62.)

SECOND YEAR

SEPTEMBER

1. First Week. Make a study of the goldenrod. Have a whole plant for observation. Describe the roots, stalk, leaves and blossom. Note that the blossom consists of many tiny flowers. Explain the use of the roots, stalk, leaves and blossom. What visitors has the blossom? Why? Where is the honey? Why do we like the goldenrod? (See page 42.)

2. Second Week. Study the aster in the same way as the goldenrod. Explain that *aster* means *star.*

3. Third Week. Study the pumpkin or some other fruit or vegetable. Have seeds, a pumpkin and a vine with a blossom on it. Let the class examine and describe the seeds, tell when they are planted and where. Examine the vine. Describe the roots, tell their use. Describe the stalk. Cut it and note the growth. Describe the leaves and the blossom. Note how the fruit forms. When does it mature? Cut the pumpkin and describe the parts: rind, pulp, seeds. Note the arrangement of the seeds and the way they are attached to the pulp. Let the pupils tell the uses of the pumpkin and how it is prepared for pies.

4. Fourth Week. Study the apple or some other fruit tree. Note its manner of growth, its height, its leaning position, low branches, the way the apples are attached to the twigs, and the strength the twigs must have to support their burdens. Study the leaves and fruit.

OCTOBER

5. First Week. Study some tree in the neighborhood. Choose the one nearest the school. Study its shape, height, its manner of branching, its bark, its leaves. Select another tree of different species. Compare it with the first one. Learn the names of each. Speak of their uses. (See page 38.)

6. Second Week. Study the linden or some other tree, in the same way.

Study the bear. Describe the bear's fur coat, his body, his head, ears, eyes, mouth, teeth, feet and tail. Compare his feet with those of the cat and dog. Discuss his home, food and habits. What are the young called? Speak of the ferocity of a mother bear. Does the bear ever change his coat? How? When?

7. Third Week. Study the owl. If possible, secure a stuffed owl. Note its peculiar characteristics. Discuss its head, big eyes, beak, its short neck, short tail, large wings, its short, strong legs, its feet and claws. Note its very soft feathers. These help to make the owl's flight noiseless. Discuss the owl's home, food and habits.

8. Fourth Week. Discuss the work on the farm at this time; digging vegetables, husking corn, etc.

Study the potato. Note its general appearance and its parts. When and how was it planted? How did it grow? Describe the plant. When is it dug? How is it stored? How taken to market? (See Vol. III, page 8.)

NOVEMBER

9. First Week. Make a study of oaks. Note the manner of growth, the bark and the leaves. Discuss the acorns and their use. Teach the pupils to recognize the common oaks and to call them by name.

10. Second Week. Study modes of travel. How did the Indians travel? The Dutch people? How do the Eskimos travel? The people on the desert? How did the Pilgrims get from one place to another? How did our grandfathers travel? How do people travel now? What way of traveling do you like best? Why? (See Vol. III, page 49.)

11. Third Week. Study the turkey. If possible, visit a poultry yard in which there are turkeys. Let the pupils note the characteristics of these fowls. Note the peculiar head, the long neck, the long tail, the long, strong wings. Note also the different kinds of feathers found on different parts of the body. Learn the habits of the turkey: where it likes to roost, how it wanders far from home. Lead the class to see the necessity for the strong wings and the long legs. What do turkeys eat? What kind of eggs do they lay? Are the young easily raised? Of what use are turkeys?

12. Fourth Week. Ask the pupils what they expect to have for their Thanksgiving dinner. What do they especially like? Make a little study of the things mentioned as favorite dishes. If sweet potatoes, cranberries, celery, oysters, or some fruit that is not home grown, is mentioned, make a study of it. There should be time to study two or three articles.

DECEMBER

13. First Week. Make a note of the birds that are still to be seen. Tack food trays to the window sills and keep suet and cracked nuts, pieces of doughnuts and crumbs on these trays. Study the birds as they come to feed. By keeping very still, children may get them to feed from their hands. (See page 58.)

Compare the length of December days with that of June days. Where does the sun seem to rise now? Where does it seem to set? (See page 18; Vol. III, page 25.)

Study one or two evergreens if there are some in the neighborhood. Teach the pupils to identify the native evergreens. Make a special study of a spruce or a fir, if the material is at hand. What are these trees good for?

14. Second Week. Study the camel. Note its peculiar appearance, its covering, its head, neck, body and its padded feet. Where does it live? For what is it useful? How can it live in the desert? How does it protect itself from sandstorms? What does the camel eat? Call attention to its feet. Of what use is its hair?

15. Third Week. Study the reindeer. Have pictures to illustrate them. Describe them, their food, their use, and the land in which they live. Why cannot horses live where the reindeer do?

JANUARY

16. First Week. Make a study of plants that give us foods. Name the vegetables, the shrubs and trees that bear fruit and nuts. Make a list of those whose leaves we eat; another of those whose roots we eat; others whose stalks, fruit or seeds are eaten. (See page 33.)

Study grains. How do we prepare them for food? What do we get from wheat? From corn? From rye? Who grinds them? Explain how wheat flour is made so white. Have samples of whole wheat flour, white flour, corn meal and rye meal. Have samples also of the grains. (See page 47.)

Have a sample of rice for the pupils to look at. Let them tell what it is, if they know. If not, tell them. Let them compare it with wheat and oats. Tell the pupils that in the field it looks much like oats, but it is darker. Tell how it is cultivated, harvested, prepared for market and shipped.

Show a picture of a bobolink. Tell the pupils that in the fall this bird goes south, changes his plumage to dull brown, and is known as the rice bird because he feasts on the rice fields.

17. Second Week. Note how icicles are formed, the length of them and their surface. Why are some smooth, while others have ridges? Where are they the longest? Why? What becomes of them? (See page 22; Vol. I, page 353.)

Study oats and oatmeal. Have stalks of oats. Recall how they grow, what is done with them when they are ripe, how they are harvested, threshed, stored and finally shipped to big factories, where they are made into oatmeal. How does mother cook oatmeal? Ask her.

18. Third Week. Discuss the things we eat on oatmeal. Where does cream come from? Where is the cow kept? How is she cared for? How often is she milked? Explain the precautions necessary to keep the milk clean. How is it cooled, bottled and delivered to us? How should we care for it to keep it pure? Can we use sour milk to make anything to eat? What can be made from cream? What can we make from milk? How do we make butter? (See page 78.)

19. Fourth Week. See how many know where white sugar comes from. Have pictures of sugar cane, samples of brown and white sugar and some sorghum. Discuss with the class the cultivation of sugar cane. Tell them what it looks like, how it grows and what is done with it when it is ripe. Explain briefly how the cane is ground and the syrup made. How is this finally converted into sugar? Explain the use of sugar beets in making sugar.

Study briefly the ways in which animals help us. What ones are good to eat? Teach the name of the meat which comes from the common animals.

FEBRUARY

20. First Week. Make a study of shelters. Ask why people need shelters, what kind the Indians have (see Vol. III, page 52), what kind the Pilgrims had, what kind the Eskimos have and what kinds we have. Show several kinds of brick. Let the pupils rub pieces of brick together. What kind of material results? It is clay. Explain briefly how brick is made. If there is a brick yard near, take the class to see it. Tell how the bricks must be laid straight and walls made smooth. Explain that mortar is used in laying bricks.

21. Second Week. Make a study of building stones. If there is a stone quarry near, take the class to visit the quarry. If not, have pieces of limestone, sandstone, marble and granite. Let the pupils rub two pieces of each kind of stone together. Which ones are easily worn away? Which would be apt to crumble first? If any well known building is made entirely or in part of any of these stones, take the class to see it. Tell the pupils how these stones are taken out of the ground, how they have to be cut up, the rough edges trimmed off with hammers and chisels. It is a great deal of work to get the hard stones (granite) ready for buildings. Sandstones are used for foundations.

22. Third Week. Discuss the manufacture of lumber. Have pictures of the pine forests, logging camps and the loads of logs going to the river.

Recall Hiawatha's home by the lake with the dark pine forest back of it. (See Vol. I, page 131.) Describe the great forests. Tell the class how the wood cutters chop the great trees down, trim them, load them on wide sleds and haul them to the river, and how in spring they are floated down the river to great mills. Here iron hooks pull the logs over little cars that run quickly back and forth past round saws. These peel the bark from the logs, then slice them into boards. These are called "green lumber" because the sap of the trees is still in them. After they have lain in the sun for several months, the sap dries up and we call the lumber "dry" or "seasoned" lumber. Then it is ready to use in building houses or furniture.

23. Fourth Week. Discuss fuel with the pupils. Tell them briefly how coal was made, how we get it. Let them tell how we get wood.

MARCH

24. First Week. Let the pupils tell what they know about the wind. How can we tell that it is blowing if we are in the house? What work does the wind do? (See page 24; Vol. III, page 13.) From what direction does the wind come? Teach the points of the compass.

25. Second Week. Note the return of the summer birds. Study the robin. What is he finding to eat? How does he find his way north every spring? (See page 64.)

Make a study of the building of a house, if one is being erected near the school. This is a preparation for geography work to come later, but care should be taken that the work is not made difficult for the pupils. How is the excavating done? What is done with the dirt? Why do houses have cellars or basements? How are they made? When is the chimney started? Why? What kind of floor has the cellar?

In case there is no building being erected near the schoolhouse, do not attempt this work. Instead, make a study of the rabbit. If some child has a tame rabbit, ask him to bring it to school some morning. Call attention to its covering, its color, its long ears, large eyes, peculiar mouth, split upper lip, its teeth and its tail, legs and feet. (See *Nature Study*, page 86.)

26. Third Week. Note the progress of the building. Speak of the materials used. Of what is the framework made? Why? What holds the timbers together? Are the timbers rough or smooth? Why? Where did they come from? Discuss the material of which nails are made. Where do we get it?

An early spring flower, or a potted hyacinth, tulip or narcissus may be used for study, instead of the house.

27. Fourth Week. When the house is being enclosed, talk about the way the siding is put on, and why the boards overlap each other. Why is building paper used? What kind of paper is it? Note the way shingles are made and discuss the reasons for it.

Discuss the shape of roofs and the reason for their not being perfectly flat. Why do we have eave spouts? Talk with the pupils about the lath and plaster, how it is put on and why used.

Have a plant for the class to observe. If an outdoor one, let them tell where it grew and when it blossomed. Let them describe it.

APRIL

28. First Week. Study buds. Talk about the trees' babies, what they are and how cared for. Why are the pussy willows hidden under brown scales? What happens to these as the pussies grow? Keep a bunch of pussy willows in water, keep the water fresh, and note the development. What do the pussies finally become? Study the alder tags also. Note their arrangement on the stem. What other trees have similar babies?

On a rainy day let the pupils watch the rain drops. Do they fall straight or slanting? If slanting, why? What are they doing to the windows, houses, trees and plants? What are they doing to the roads? Are farmers glad to have the rain? Why? Why does some of the water *run*? Why does it not stand still on the ground? What will become of the water that does stand still? (See Vol. I, page 360.)

If there is a nearby creek, visit it after the rain. Is it clear or muddy? If muddy, where did the mud come from? What will become of it? Call attention to the little ditches made by the tiny streams running into the creek or down the road. What does the stream carry besides mud? (Pebbles, leaves and sticks.) (See page 28.)

29. Second Week. Study an early spring flower; the arbutus, the pasque flower or any other flower that is easily obtained. If one can secure the pasque flower, it is good to study because of its size. Note the absence of leaves, the furry covering, the color, shape of the flower and the parts. Let the pupils tell where it grew, on which side of the sandy hill the first flowers opened and when we may find the leaves. (See Vol. I, page 360.)

Study the mouse. Catch one alive, put it in a wire netting cage with bits of paper and some old rags. Let the pupils feed it and watch it eat. Let them note its characteristics. What other animals are similar to the mouse in habits? Why do we not like to have these creatures around us? (See page 83.)

30. Third Week. Study a robin's nest. Of what is it made? How is it put together? Is the robin a good home builder? Where are robins building now? Develop the fact that robins like to be near

people, sometimes building on porches. They may be made tame enough to eat from one's hand and to allow gentle stroking. (See Vol. I, page 361.)

31. Fourth Week. Study the blackbird. Besides its characteristic features, note the way it walks. Discuss its nest, eggs, food and habits. Later study the red-winged blackbird in the same way.

MAY

32. First Week. Study an elm tree. Note its size, shape, manner of growth and its general appearance. Study its leaves, blossoms and seeds. (See page 39.)

33. Second Week. Study the violet. Have a whole plant. Let each child have a blossom and a leaf. Describe the roots, the leaves, the way they rise from the root, the flowers and seed pods. Discuss the varieties of violets. Have as many different kinds as are obtainable. (See Vol. I, page 362.)

34. Third Week. Review the facts learned in the fall about the linden. Study its flowers and seeds.

35. Fourth Week. Study the wild daisy. (See page 43.) What other flowers does it resemble? Is it similar to the wild aster. It consists of two kinds of little flowers packed tightly together. Where does it grow? Do we like it? Do farmers like it? Why not? The plant bears many tiny seeds, and this makes it difficult to get rid of the plants. They crowd the grass out of meadows and so render the land useless, unless one works hard to overcome them.

JUNE

36. First Week. Study the rose. Describe its characteristics. Examine the flower. Describe it and tell why we like it.

37. Second Week. Study the Baltimore oriole. If possible, have a last year's nest for the class to examine. Describe the bird and its mate. Why is the mother bird a duller color? What do these birds eat? Describe the nest. Where is it built? Why? (See page 128.)

THIRD YEAR

SEPTEMBER

1. First Week. Make a study of the sunflower or some other fall flower. Note where it grows, its height, its roots, the kind of stalk it has, the kind of leaves and the blossom. Note that there are two kinds of tiny flowers in the blossom; the disk flowers and the ray flowers. Examine the seeds; discuss their uses.

2. Second Week. Study the corn. Note the kind of roots it has, the kind of stalk, leaves, the arrangement of the leaves on the stalk, the number of ears, the tassel and the pollen. Discuss the way the pollen reaches the ears, the effect of pollen from different kinds of corn reaching the ears, the manner in which pollen is carried. (Have ears showing a mixture of kernels.)

3. Third Week. Study the uses of corn.

(1) As a vegetable.
(2) As meal.
(3) As grain.
(4) Hominy.
(5) Corn starch.

4. Fourth Week. Study the grasshopper or cricket. Note the three parts to its body (head, thorax and abdomen), its wings, the number and kind of legs, its eyes, mouth, feelers, the use it makes of its legs. Study its food and the manner of eating. Tell the children of the life history of a grasshopper. Speak of the damage it sometimes does. (See page 15.)

NOTE: As a substitute for the work of the second and third weeks, the weeds described on page 42 may be studied. In rural schools this is recommended, especially in localities where these weeds are common.

OCTOBER

5. First Week. Make a study of nut trees, or any native trees. Study the shape, the manner of growth, the size, the kind of bark, the leaves and the fruit or nuts. If the nuts are shipped, discuss the way they are picked, packed and shipped.

If peanut plants are obtainable, study them. Note how they are gathered, how prepared for market and shipped. Crush a nut meat on a clean blotter. Let the children note the oil that escaped.

6. Second Week. Discuss the fruits of the orchard. What are they? How do they grow? When are they ripe? How picked? How packed? How shipped? Where shipped?

7. Third Week. Discuss wormy fruit and nuts. Explain to the pupils how this happens. What can be done to prevent it?

8. Fourth Week. Make a study of oaks. Discuss the uses of oak lumber and its value.

NOVEMBER

9. First Week. Discuss the weather. Note the short, hazy days, and the effects of frost on different things. Teach the pupils to use the thermometer. (See Vol. III, page 20.)

10. Second Week. Talk of the preparation for winter by plants.
(1) Storing nourishment in roots, bulbs and fleshy roots.
(2) Ripening seeds.
(3) Dropping leaves.

11. Third Week. Talk of the preparation for winter by animals.
(1) Migration of birds.
(2) Putting on of heavier coats by northern animals. Changing color.
(3) Hibernating.
(4) Storing food.

12. Fourth Week. Discuss the preparation for winter by people.
(1) Storing food. What kinds? Where?
(2) How are these foods used?

DECEMBER

13. First Week. Make a study of the Big Dipper and the Evening Star.

Study the spruce, balsam fir or any common evergreens. If these are unobtainable, use holly or mistletoe. (See page 39.)

14. Second Week. In connection with the study of Palestine, review the lessons of the second year on the sheep, and the way in which they are cared for in Palestine. (For sheep raising in the United States, see Vol. III, page 30.)

Study the donkey. Note its peculiar characteristics. Why is it used so commonly in mountainous countries.

15. Third Week. Review the facts concerning the camel: where it lives; why it can live in the desert; how it is cared for; and its value to man.

JANUARY

16. First Week. Talk about the moon, where the Big Dipper is, and locate the Milky Way.

Discuss the forms of water: vapor, dew, frost, clouds, rain, snow and ice. Use a teakettle and an alcohol lamp to experiment with. (See page 16.)

17. Second Week. Discuss the use of clouds and snow as blankets. (See page 22.)

Discuss the value of ice.

Study the white bear and the reindeer.

18. Third Week. Study steam and its uses. (See page 21.)

19. Fourth Week. Study the English sparrow. Let the pupils describe the male and the female, the manner of flying and feeding, the kind of nest built, their food, their relation to other birds.

FEBRUARY

20. First Week. Study the bluejay or some other winter bird. Let the pupils describe him, his note, his nest and food. Learn his good qualities as well as his bad ones.

21. Second Week. Discuss the uses of fire in giving heat, cooking food, laundering, working up iron and other metals, breaking up ice, preventing frost and in illuminating houses and streets. Speak of the materials of which fire is made, and of the danger in using some of them (coal, gasoline, oil and gas).

22. Third Week. Recall the lesson on coal taught in the second year. Tell the pupils more about coal mines, how they are worked, how the coal is carried to the hoisting shaft, how shipped.

23. Fourth Week. If gas is commonly used, explain that it is made of coal. Describe an oil well.

MARCH

24. First Week. Study air currents. Hold a handkerchief, a feather or a bit of paper over a register. Note what happens. Discuss winds and what they are. Explain that warm air rising in the warmer parts of the country helps to start the winds. What work does the wind do? (See page 24.)

25. Second Week. Study buds, such as the pussy willows, alders, hickory, chestnut or horse chestnut. Note the position of the buds on the stem (terminal and lateral). Which are the better developed? Note the arrangement of the lateral buds (opposite or alternate). Discuss the covering of the buds and their further protection from the weather. When do the buds develop? Explain how they help to make the old leaves fall in the autumn.

Make a study of the Ostrich. (See Vol. III, page 16.)

26. Third Week. Have lessons on the making of maple sugar. When are the trees tapped; how? How is the sap caught? In what kind of weather does it run best? How is it gathered; how cared for? Discuss the boiling down of the syrup, how it is cleared, how stored? Compare the cost of maple sugar with the ordinary cane sugar.

27. Fourth Week. Study a pigeon. Note its color, its graceful lines, its head, bill, large eyes, large wings, its feet. See how many know what kind of a home it builds, how many eggs it lays, how long it takes the eggs to hatch. What are the young called? Tell the pupils of homing pigeons.

If time permits, study the mourning dove. Compare the two birds.

APRIL

28. First Week. Talk to the pupils about the vegetables and flowers they like best. Distribute seeds of favorite plants to each child,

Discuss how the seeds should be planted and let the children make gardens at home. (See page 30.)

Study the sun: where it is, its size, its apparent movements, the earth's movement about the sun and the work the sun does. (See Vol. III, page 25.)

29. Second Week. Study streams. How are they formed? Why do they follow the courses they do? Why do they wind? Why are they sometimes muddy? What becomes of the mud?

Discuss the channels cut by many rivers. Show pictures of the Colorado Canyon. Discuss the overflow of streams — the Ohio, Mississippi and Nile. (See Vol. III, page 47.)

30. Third Week. Study the formation of soils. Secure fresh pieces of limestone, sandstone and marble. Let the pupils rub together two pieces of each kind of rock. Note that sand results from sandstone and marble, and clay from limestone.

Have samples of soil for the pupils to examine. What is the rich, black substance in good soil? Note that the best soil is a mixture. (See pages 37 and 40.)

Speak of frost being a powerful agent in breaking up rock. Rain dissolves the cement that holds the little particles of rock together and then washes the particles away. The softer the rocks, the more quickly they are broken up.

31. Fourth Week. Study earthworms. Make a small terrarium and fill with fine sand or garden earth. Place three or four large worms on the top of it. Study them as they burrow. When they have disappeared, scatter a little grass or a few dry leaves over the earth. Note what happens. Keep the earth moist. (See page 9.)

Since these worms work at night, encourage the pupils to study them at home evenings, by the aid of a lantern. Caution the pupils not to handle them much because the worms have a keen sense of touch, and are therefore easily hurt. Let the children discover if the worms have eyes, ears or feet. Have they a sense of smell? Where does the worm come from? Explain that the eggs are so very small they can hardly be seen. See what the pupils think of angle worms "raining down." Let them see how easily they climb a pane of glass that is almost verticle. What do the worms eat?

MAY

32. First Week. Study the meadow lark and the flicker. (See Vol. I, page 369.)

33. Second Week. Secure a toad, place it in a box with glass sides and a wire netting cover. In the box place two or three inches of moist earth. Let the pupils bring in all kinds of worms and insects.

Place these in the box with the toad, while the pupils all watch. How does the toad eat? What does he like? Is he useful?

If there is no pond near, tell the pupils what the eggs look like, where they are placed, and how they develop. Tell the children how the toad changes his clothes. (See page 68.)

34. Third Week. Study the cowslip and spring beauty. Each child should have a leaf and a flower, but the teacher should have a whole plant, so that in each case the class can see the roots. (See Vol. I, page 369.)

35. Fourth Week. Study the elm and birch. Note the general appearance of the tree, its manner of growth, its bark, leaves, blossom and seeds. Let the pupils describe their gardens. (See Vol. I, page 370.)

JUNE

36. First Week. Study the house fly. Flies and mosquitoes may be kept in bottles while the class study them. Note the parts to its body, the number of legs and wings, the eyes and mouth. Let the children tell, if they can, where flies breed, how the young develop, how these insects carry disease germs, why and how they should be exterminated. If time permits, study the mosquito in the same way. (See page 121.)

37. Second Week. Make a study of the wild rose or of any other common flower. Where does it grow? When does it blossom? Describe the plant. Note the variation in the color of roses on different bushes. Study the flowers. Why do they close at night? What forms after the blossoms disappear? How long are the rose hips pretty?

CHAPTER TWO

PHONICS

MRS. E. E. OLCOTT, A.M.

Head of Teachers' Course, Central Normal College, Danville, Ind.

INTRODUCTION

"Word recognition is the essential basis of all reading, the only possible basis of reading,"—James L. Hughes.

For *independent recognition of words*, every method of teaching primary reading in use today, with very few exceptions, depends, more or less, upon *phonics*. In proof of this, note the following extracts from seven widely-used series of readers:

"The power to pronounce the word is a prerequisite in any method of teaching reading. There can be no independent thought-getting without this power."— *The Beacon Method.*

"From the beginning the teacher of reading should have a goal in mind, namely, the ability of the child to recognize new words without aid. This gives him independence in reading.

"The ability to recognize new words *for himself* is acquired through the study of phonetics, and there is no branch of teaching reading that is more important. Daily drill and review drills are necessary in order that the children may acquire phonetic power."— *Manual of Story Hour Readers.*

"The ability to call words without hesitation is the first essential to good reading. This ability gained, most other difficulties vanish. If we could interpret a hieroglyphic inscription into articulate sounds representing words familiar to our ears, we could read and understand the same. The letters are to the child just what hieroglyphics are to us. . . .

"When the teacher reads to the pupil, she simply interprets the sound values of the letters and their combination, and expresses these sounds in articulate words familiar to him through the ears. (She

simply pronounces the words.) If the pupil can be taught to recognize all the sound values of all the letters and combinations of letters he can act as his own interpreter. . . . He will no longer need the teacher to read to him or tell him. He will act as his own interpreter and will take great delight in so doing."— *Manual of Story Method of Teaching Reading and Spelling.*

"Phonics, wisely taught, will put the child into possession, during the first year and a half of his school life, of a complete key to the language, so that, no matter how soon thereafter his schooling may cease, his ability to read will be assured." — *Manual of the Rational Method.*

"If these (the short and long vowels and digraphs taught in *The First Reader*) are thoroughly fixed during the first half of the book, the child should become practically independent of further mechanical instruction. . . . In one sense he could almost go on without a teacher and finish the rest of the series." — *Child Classic Series; Second Reader.*

"The phonetic facts are exceedingly simple. The basis of our spoken language is a certain number of elementary sounds. One or more of these sounds makes up each spoken word. Our written language consists of symbols which represent the elementary sounds. As the elementary sounds are combined into spoken words, so the simple symbols are combined into written words.

"The problem of learning to read is also simple — to state and comprehend. It consists in associating the elementary sounds of spoken language, which is already familiar to the ears of English-speaking children, with symbols which represent those sounds, so that when a symbol or series of symbols is seen, they at once suggest their corresponding sound or sounds.

'What the child needs is to form the habit of pronouncing a letter or combination of letters in a certain way, the habit of pronouncing a letter or combination of letters in the way that he has pronounced that letter or combination of letters before. Only thus can he acquire the ability of reading independently."— *Manual of the Aldine Readers.*

"It may be objected that as English is not a phonetic language, any method of teaching to read which is based essentially on phonics is foredoomed. What can you do, rationally, with the language of *cough, dough, rough, bough*?

"A sufficient answer to this objection is: Rightly used, phonic methods are highly effective, even in English. This has been too thoroughly tested to be doubted. Even when wrongly used, phonic methods accomplish results of value." — *Manual of the Horace Mann Readers.*

1. Essentials. Taking for granted, then, that phonics has an important part to play in the teaching of reading, let

us consider very briefly what the child must learn to enable him to be independent.

(1) He must know the sounds of the letters of the alphabet as they stand alone and in certain combinations.

(2) He must know how to blend these sounds into words.

These two things are practically all there is of phonics. The efforts to overcome difficulties, and to discover the simplest, most effective way to teach these essential things have given rise to many phonetic methods.

2. Difficulties. Two of the difficulties are these:

(a) Learning the Sounds. In itself, learning the sounds of letters is as abstract and as *dry* as learning the alphabet by the old A-B-C method. The drill becomes drudgery, and reading distasteful.

(b) Blending. Blending the sounds so that the word is easily recognized, is very difficult, especially with such letters as *b*, *d*, *g*, and others. It is not easy to hear *grand* in blending like this: *guh-er-a-n-duh*.

Facility comes with drill, drill, drill. But it may be a fatal facility, the child, intent on *form* and *sound* of words, may lose all interest in the *meaning*. He learns to read smoothly but without appreciation.

3. Devices. (a) Stories and Pictures. To overcome the *dryness*, most of the methods of teaching reading use stories to introduce sounds. One group of methods, including the *New Education Readers*, the *Story Method of Teaching Reading*, and others, use pictures to heighten the effect of stories. (Section 14.)

Some critics say that the interest aroused by pictures is fictitious, but defenders hold that pictures appeal to children whom stories do not reach, that pictures serve to *recall* stories, and to add variety to drills.

(b) Diacritic Marks. A small group of methods, notably the *Rational*, depends upon diacritic marks, underscoring, etc., to overcome the phonetic shortcomings of the language, and holds that as soon as the child can pro-

nounce words he will enjoy reading. Critics say that the child who depends upon *marks* cannot read well outside of his own primer because words in other books are not marked. Almost without exception, recent methods discard diacritic marks, and depend upon a few simple rules (Section. 10) which hold in all readers.

(c) Consonants. The general plan followed by most methods of teaching phonics is to present consonant sounds first (from two or three to a score); then present one or more vowels; blend the sounds into words; use certain words or parts of words as family names; gather words, so far as possible, into family groups; then drill on blending until the child becomes expert in pronouncing words wherever he meets them.

(d) Word Families. A slight variation is to *find* sounds and family names by analyzing *type words*; thus if *ran* is a type word, the new word *fan* may be found by comparison, arranging the words in a column:

r — an
an
f — an

The *Horace Mann Readers* go a step further in their *problem method*. The problem is to pronounce a new word; it is solved by analysis and comparison. The Manual says: "The formula which has been cited,

not	let
n ot	l et
n	et

net

means simply: "In this strange word, *net*, the first part is sounded like the first sound in *not* and the latter part is sounded like the latter part of *let*." But whatever plan is followed it comes in the end to learning the sounds and blending them into words. Blending is the more difficult of the two and the more important.

(e) Use of Phonograms. The majority of primers teach blending by prefixing phonograms to *family names*,

thus: *and*, *sand*, *bland*, *grand*. If *grand* is the new word, the child is taught to see the family name, *and*, then to note the sound of *gr* and blend the two. But too often the child *sounds ger-and*, *bul-and* for *grand* and *bland*, hence fails to recognize the words.

To overcome this difficulty the *Beacon Method* comes to the rescue with *The New Phonics*. This, according to the author of the *Beacon Method*, consists chiefly in "eliminating blend difficulties by tying the vowel to the initial consonant as a helper. . . . Under this system there is no necessity for the teaching of *families*. . . . By placing the vowel with the initial consonant instead of the final consonant, the number of forms to be taught is reduced from the several hundred of other phonic methods to between sixty and seventy necessary forms — the blends of fifteen initial consonants with the five short vowels." Thus instead of *gr-and*, the *Beacon Method* would have *gra-nd* (short *a*) and build by *endings* rather than *prefixes*. This is probably the latest thing in blending, yet the author frankly states that he bases it on Noah Webster's *Spelling Book*.

(f) Special Letters. The *Beacon Primer* on page 1 says: "Teach the sounds of the following letters: *s*, *f*, *h*, *t*, *b*, *r* . . . and the sounds of short *a*; also *ba*, *ha*, *la*, *ra*. . . . When the child has mastered these, build groups upon the blackboard as follows:

ra — n	ha — d	ta — g
ra — t	ha — t	ta — n
ra — p	ha — m	ta — p"

This plan certainly does away with *sounding huh*, *tuh*, *buh*, *guh* and *ger* for *h*, *t*, *b*, *g* and *gr*, and to that extent makes blending much easier. There might be some question about the *dryness* of mastering *ba*, *ha*, *la*, *ra*, etc.

SUGGESTIVE PLAN

4. The Eclectic Method. From the foregoing brief survey of many methods it will be seen that the following suggestive plan for teaching phonics takes advantage of the good

points in all of them. The purpose is to make one method supplement another, and to use every device to make lessons in phonics akin to *rest exercises*, because "He goes the fairest, shortest road who travels with pleasure."

5. First Steps. (1) Begin phonics on the first day of school by playing the *Sharp Ears* game, thus training ear and tongue. (Sections 9 and 13.)

(2) During the first week begin teaching the children their *name-sounds*, that is, the initial letters of their Christian names (Section 25-9). Explain that everybody has a name and every name begins with its own sound, so everybody has a *name-sound*. Mary's name-sound is *m*; listen and you will hear it. *M-ary*. Alice's name-sound is *a*; speak her name slowly. *A-lice*.

(3) As soon as the children grasp the idea of name-sounds, write the *sign* for the sound, the initial letter, thus associating sound and symbol (Section 10-b). Each child will enjoy writing his own name-sound and should be encouraged to write those of his friends, when he has learned to use the crayon. (See *Penmanship*, Volume II, Chapter VI.)

(4) When each child knows at least his own name-sound, add to the interest by telling a story, or stories, which introduces some of these name-sounds and also other sounds not found among the pupils' initials. (Section 14.)

(5) Add still further variety by using pictures to bring out fancied resemblances (Section 10-a and Section 14). Do not take such pictures too seriously, they are just a bit of fun to be used only where they help.

(6) As soon as practicable, probably during the second or third week, begin using sounds to build words, as, *it*, *m - it*, *s - it*, *f - it* (Section 32). The *Sharp Ears* game prepares the way for this, for now the eye is used as well as ear and tongue.

6. Use of Reading Lesson. Select words from the reading lessons in the primer and make them the centers of family groups. If a sight word in the primer is *see*, then by

analogy bring out *tree, free, three,* and call attention to *ee.* Or if *ball* is a sight word, focus attention upon *all,* saying nothing about the sound of *a,* and bring out *call, fall, tall,* etc. Thus gradually develop a chart similar to the phonic chart of the *Aldine Method.*

(a) The Goal. The goal in word building is the unconscious silent blend. The child becomes so expert that he pronounces a new phonetic word at sight without conscious effort. The Manual of the *Horace Mann Readers* uses the expression, "oral, whispered, and silent blend," which aptly describes three important steps. The child first blends orally, he is next encouraged to think how it sounds — with his lips shut. If he is unable to do this let him whisper the sounds, ever striving to be able to think them silently. Learn to blend by blending; that is the only way. The more practice the better, so long as it is done with interest.

(b) Plans. The *Beacon Method* plan and the *Aldine Method* plan may easily supplement each other. First build by prefixes, forming a family group; then tie the vowel in the family name to the initial consonants and build by endings, as:

c — amp	ca — mp
st — amp	sta — mp
tr — amp	tra — mp

Have the pupils recite the short and long sounds of the vowels, then tie the vowel to a consonant, and finally build words by endings, as:

a	e	i	o	u
ba	be	bi	bo	bu
ba — g	be — g	bi — g	bo — g	bu — g
ba — d	be — ll	bi — t	bo — ss	bu — m
ā	ē	ī	ō	ū
blā	blē	blī	blō	blū
bla — de	blēa — ch	blī — nd	blōa — t	blū — e

When name-sounds are written on the blackboard they may also be written on cardboard, and the use of phonetic

drill cards be introduced. Most methods include drill cards for sight words and for phonics (both letters and phonetic words). These the teacher should possess and add to them cards of her own making, the outgrowth of her words in her own schoolroom.

7. Games. To keep drill words interesting, games should be very freely employed. Most of the devices used to give life to learning sight words may be utilized in phonics as well. Here are a few of the many games which add spice to practice on sounds and blends.

(a) Sharp Ears. (Section 13.)

(b) Name-Sounds. (1) *Visiting.* The teacher chooses the first child, Cora, who goes visiting. She goes to Bertha's desk, and bows and says *b*; Bertha rises, bows and says *c* (Cora's name-sound). If she does not say *c*, then she must sit down and *stay at home.* If she gives *c* correctly, then Bertha and Cora go to Alice and Della, respectively, and say *a* and *d*. If the responses are correct the four go to four others, and so on until everyone has been visited.

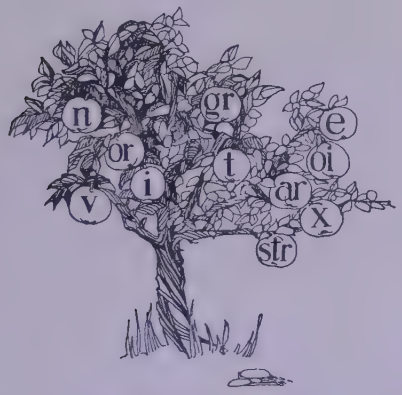
(c) Drill Cards. (1) *The Phonic Class.* This is an adaptation of the old-fashioned spelling class, where those who missed were turned down and head marks were given. The class stand in a line and give the sounds on the drill cards instead of spelling words.

In the same way, the spelling match becomes a match in phonics; sides are chosen and sounds given instead of words spelled.

(d) Racing. Drill cards are scattered about the room. At a signal each pupil races to get a card. If he gives the sound correctly he keeps the card and races to get another. The child who holds the most cards wins the race.

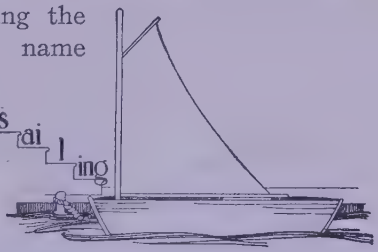
(e) Sight-word Games. (1) *Jack Horner's Pie.* The pie may be a box; the plums, slips of paper bearing phonograms or phonic words. The child sticks in his thumb and keeps the plum if he gives the sounds correctly. Or the pie may be a circle drawn on the blackboard and the plums words written within.

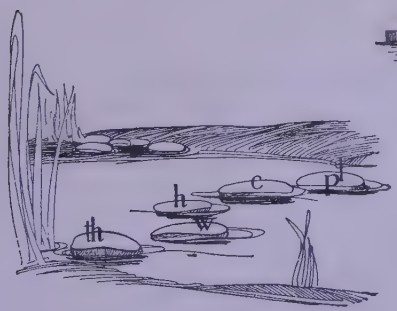
(2) *Picking Fruit.* Draw on the board a tree, bearing any kind of fruit; red apples, cherries, yellow oranges, or purple plums. Beside each apple write a phonogram. The child giving the correct sound picks the apple.



(3) *Climbing the Ladder.* Draw many stars high on the blackboard with a long ladder reaching up to them. Beside each rung of the ladder write a phonogram. The child who reaches the top by giving the sounds correctly writes his name among the stars.

(4) *Taking a Ride.* Those children may ride in a wheel-





barrow, a wagon, or a sail-boat, who can buy a ticket by giving phonograms correctly.

(5) *Stepping Stones.* Wavy lines form the banks of a brook. Stepping stones,

with phonograms written beside them, cross the brook diagonally. If the child misses a sound he gets his feet wet.

(6) *Gathering Autumn Leaves, Catching Butterflies* and similar games are played by scattering about the room leaves or butterflies which have been cut from paper, colored and inscribed with a phonogram. The children gather and catch as many of these as possible, by giving the sounds correctly.

(f) Choosing the Pictures. This is a game for the silent blend. Cut out pictures which illustrate new phonetic words, as, *duck, pig, rose*, etc. Mount these and have the children name them. Then write a word, as *duck*, on the blackboard, let the children study it silently and select the picture which illustrates it.

These ten games should suggest many more which may be invented along similar lines.

Phonetic drills should be limited by two things; interest, and the time there is to spare for them. The *thought-side* of reading must have the lion's share of time. A child cannot have too much skill in pronouncing words. He simply has not enough skill in using them to get thought. Then, instead of throwing away word-drills, increase thought-drills. Provide a liberal supply of supplementary readers which tempt the child to work out words in order to get the story.

For this purpose the stories at the end of each chapter on *Reading* are excellent. First year pupils, for instance, will be so anxious to read *This Is the House that Jack Built* all by themselves that they will try to discover the pronunciation of the new words. *Chicken-Licken* is equally good for pupils in the second grade, and *Thumbelina* will interest those in the third grade. It is a good plan to read or tell the first part of a story and then say, "This story is told in the first reader that I hold in my hand. I think you can read the rest of it by yourselves. Then tomorrow you may tell it to me. I want to see how many new words you will be able to pronounce." This plan appeals both to the

curiosity and the pride of the children, and consequently they will put their best effort into reading the story. As soon as the pupils perceive that by mastering phonics they are gaining the ability to read by themselves, they will manifest a permanent interest in the work.

PHONICS FOR FIRST TWO GRADES

8. A Separate Study. Keep the reading period for the undisturbed pleasure of genuine reading. The work in phonics should be kept apart from the reading lesson proper, especially during the first year in school. Gradually, through the training in phonics, the pupils gain ability to make out words for themselves, largely by trying the drill words and phonograms (written or printed representations of sounds) on the new words they meet in silent reading.

9. Training Ear and Tongue. (a) TRAINING THE EAR. Use the *Sharp Ears* game ("spelling by sound," for pupils to recognize and pronounce words). This is *ear training.* (See *Suggestive Lesson One,* Section 14.) The teacher spells by sound the following:

(1) Phonetic names of familiar objects in plain sight in the room, which children may point to or touch; as, chalk, desk, wall.

(2) Phonetic names of actions which children may perform; as, clap, stand, sit, bow, run.

(3) Phonetic names of parts of the body, which children may readily touch; as lip, teeth, knee, toe, etc.

(4) Phonetic names of pieces of wearing apparel; as, cap, hat, shoe, dress, waist.

(5) Phonetic names of colors; as, red, green.

(6) Phonetic names of substances; as, glass, tin.

All of the foregoing should be in sight; now give exercises on things out of sight.

(7) Play the *Wonder Box* by giving phonetic names of objects (toys) which are concealed in a box. The teacher spells by sound the name of one. A child, recognizing the name, whispers it to the teacher, and is then permitted to

take the object from the box and show it to the class. In the box may be placed a doll, ball, knife, top, a pin, a nail, a cone, and such toys as a sheep, a duck, a tree, etc.

(8) Phonetic names of any animals or objects may be used; as, pig, cow, rose, stone, cup.

(9) Give phonetically the initial letters of the children's Christian names, and when a child hears "his sound" let him rise at his desk or come to the teacher. Thus, Alice's sound is *a;* Bertha's, *b;* Cora's, *c.* When several children have the same sound, as Della, Dan, Donald, all stand when the sound *d* is given. As soon as children recognize each other's "initial sounds," the teacher may use this device: "Who can bow to some child whose sound is *e*?" Then a volunteer is named and he bows to Edward, or Emma.

(10) Short, imperative sentences may be given; as, *T-ou-ch y-ou-r b-oo-k.* In such sentences the child performs the action, then repeats the sentence. This differs from (2) only in degree. It is harder to hold in mind several words than only one.

(b) Training the Tongue. To train the tongue, have the children spell by sound part of the words in (a). The words should be spelled with the teacher and without her, in concert, and individually. Encourage children to attempt words for themselves; to call each other by initial sounds; to give names of objects by sound. To do things is easier and more interesting than to spell words by sound, so training the tongue is harder and not so enjoyable as the various applications of training the ear. Hence, exercises in training the tongue should be given less time than exercises in training the ear, and these exercises should be handled very tactfully. They should be presented in the light of pleasant recreations.

10. Associating Sound and Symbol. This exercise should begin within a few days after introducing the work in Section 9, and may begin on the same day. It should be presented without delay, because phonics should be used early and often, so that the habit of spelling new words by sound becomes involuntary.

RECOGNITION OF SOUNDS

(a) Resemblances. In order the more readily to associate sounds with letters, make liberal use of fancied resemblances. These resemblances may be adroitly introduced through a story, in which the dog growls (*r*); the cat says *f*; the cow, *m*; and *sh* says "be still"; *ch* is a sneeze; and *wh* blows out a candle. (See *Suggestive Lesson Two*, Section 15.)

Vowels are introduced very interestingly through the children's initial sounds, and the sounds blended into words which the children more readily recognize because of the practice in the *Sharp Ears* game. Indeed, the *Sharp Ears* game is then applied to written as well as to oral words. The use of fancied resemblances is merely temporary aid; it is a helpful finger stretched out to the toddler who is taking his first unsteady steps; it will soon be withdrawn and forgotten. (See *Suggestive Lesson Three*, Section 16.)

The following is a list of representative sounds:

ch — engine sound
ng — bell
l — wires
p — steamboat
h — breath
t — clock
sh — softly (hush)
d — dove
ee — mouse
v — beetle (flying)
f — angry kitten
ow — a cry of pain
m — cow
u — pig grunt
s — snake hiss
th — goose
a — lamb (baa)
g — frog
r — growling dog
z — bee hum
b — bubbles of water
c — (hard c) cough
w — wind blowing
wh — blowing out the light

(b) Initial Vowels. Make good use of the children's initials. Continue the work under (9) by writing the letter on the board for the child to recognize by sight as well as by sound. Write *a* on the board and let Alice rise and "sound" her letter; or, let some other child who knows to whom that letter "belongs" bow to Alice, and then sound the letter. Thus the children try to learn each other's letters.

Let Roy, Allen and Tom stand before the class; then touch each child lightly, sounding his letter and blending

the three into *r-a-t;* then write the word on the board. Write the combination of Allen's and Tom's letters (*at*) five times on the board; leave the first for the family name, then change the other four by prefixing initial letters. Roy's letter makes *rat;* Sam's letter, *sat;* Fannie's, *fat;* Fannie's and Lora's together, *flat.*

Use the small letter when writing the initial sound, because you wish to combine the letters into words.

When the children are familiar with the letters, drop all reference to initials; this device has served its purpose.

(c) First Use of Phonics in Reading. From any page in the primer choose a phonetic word, as doll, drum, nut. Write or print it on the board, let the children spell it by sound, and pronounce it. Then show them the page upon which the word is to be found and let them hunt for the word, which is playing hide-and-go-seek with them. They use both eye and ear in discovering it, and are taking the first step in using phonics when preparing a reading lesson.

11. Diacritic Marks. Introduce diacritic marks during the first year, and use them frequently enough for the children to grasp their purpose, but depend on them very little for pronouncing words. Diacritic marks for equivalents may be wholly omitted in the first and second years, and used very little in the third. The results obtained are not worth the effort which must be spent in obtaining them. For instance, in the word *move*, to remember that the two dots shows that the *o* is to be pronounced like the double *o* in *moon*, is far harder for the child than to remember *move* as a *sight word*. A child well trained in phonics, meeting the word *move* by itself, would pronounce it to rhyme with *stove*; if he met it in a sentence, he would at first pronounce it in the same way, then change to the correct pronunciation as soon as he gathered its meaning from the context.

The principal use of diacritic marks is confined to the dictionary. Many dictionaries respell most of the hard words; all dictionaries are virtually compelled to respell some words; for example, the word *one* cannot be so marked as to indicate

its pronunciation. Besides, dictionaries published by different companies use different sets of diacritic marks, so the child when older may have to use other marks than those first given.

Instead of depending to a great extent upon diacritic marks, depend upon gathering words into families, the compound phonogram being the family name. Thus, in *bright*, instead of marking *i* and crossing out *gh*, teach the phonogram *ight* as a whole, a family name. The child learns it as he learns *wh*, *th*, etc., as wholes, and prefixes other sound. When the first word belonging to some family is learned, immediately call other members; for instance, if *love* appears in a lesson, group with it *dove*, *shove* and *glove*. When *stove*, *grove* and *rove* are introduced, we pronounce them and find that though they look like the group above, they are not in the same "sound family." The meaning tells the child the pronunciation, and the context gives the meaning.

Besides teaching phonograms, or family names, point out by example certain general rules for pronunciation. For instance, introduce the macron, and tell the children that when a *vowel* wears a flat cap, it says its own name, or has its long sound. Tell them, also, what when no macron is used, there are other ways to show what the vowel says. An *e* at the end of a short word is such a sign; the final *e* is a friend that helps the other vowel to give its long sound. In *made* we know that *a* says *a*, because the *e* is there to help; in *mad* we know *a* says *a*, because it has no helper; so, in *pine*, *pin*; *note*, *not*; *cube*, *cub*, the rule holds.

Then, too, some other letters help just as final *e* does, only instead of standing at the end of the word, they stand beside the vowel which they help. In *rain*, we know what *a* says because *i* stands beside it.

After plenty of practice the teacher may make groups like these:

Long a, a....e, ai, ay.	Long o, o....e, oa.
" e, ee, ea.	" u, u....e.
" i, i....e.	

Under no circumstances should this exercise be used to introduce the work. It is a summing up which may or may not be put before the children. The rule for *ay* may be presented like this: Suppose that the word *play* comes in the regular lesson; write it on the board and have the children pronounce it (or the teacher may pronounce it for them); then cover the *pl* and pronounce *ay*. Write a column of *ay's*, underscore the top one for the family name, then call the "children." The teacher writes the "ay" child's name, and the pupils pronounce it; as, *ay*, *pl-ay*, *p-ay*, *d-ay*, etc. When a number of "children" are gathered together, the pupils may send them out to play after this fashion: The teacher asks, "Who can send a child out to play?" A volunteer comes forward and with the pointer indicates a word he knows, as *day*, pronounces and erases it. This game goes on till all of the "children" are gone. The teacher points to the underscored *ay* and asks, "What sound shall we think of when we see this?" The pupils answer, *a* (the sound).

Instead of diacritic marks for a, e, i, o and u, when they precede *r*, as in *arm*, *her*, *irk*, *orb* and *urn*, teach *ar*, *or*, *er*, *ir* and *ur*, as phonograms, pronouncing the last three alike. That plan changes an army of hard words into easy ones.

Have the pupils write many words which the teacher dictates phonetically, letter by letter; the children pronounce them when the dictation is finished. Do not dictate words containing silent letters, except those which fall under certain rules, with which the children are familiar. The teacher may say, "The next word has *e* for a helper," then dictates, *l-a-n*; the pupils add the *e* and have *lane*. Or she may say, "In this word *i* helps *a*, *r-ai-n;*" the children know where the *i* comes when it helps *a*. Usually it is better to dictate by families, giving the family name or phonogram, as *ight;* then the pupils know that each succeeding word has *ight* in it; as, *l-ight*, *s-ight*, *sl-ight*.

The next step, which is an easy one, is for the teacher to give the phonogram as *ack*, then pronounce *pack*, *lack*, as when spelling by letter, the pupils silently thinking the

sounds and writing the words. Children thus trained can master new reading lessons with surprising ease.

12. Syllabication. This is not really phonics, but the following exercise may be given in the period for phonics, because it is a means of mastering words.

Write two columns of words:

(1)	(2)	(3)
rag	bag	ragbag
sun	man	ragman
moon	shine	sunshine
	fish	sunfish
	day	Sunday
	rise	moonrise
	beam	moonbeam

Then assist the children to make a third column by putting these two together, as in (3), above.

Next write a column of words, such as the following:

(1)
sunlight
playmate
sidewalk

Then make two more columns, (2) and (3), by separating these:

(2)	(3)
sun	light
play	mate
side	walk

13. Summary. All of this may seem a great deal of work for the first year; but let it be remembered that in many cities and large towns from six to ten primers or first readers are read through. In accomplishing this, the pupils need to use all that has been suggested, and woe betide if they learn to do without phonics! They never learn to depend upon its help so confidently nor use it so skilfully. Teachers who receive into the second or third grade pupils who have had no phonics know how hard it is to teach them to use it in pronouncing words.

14. Suggestive Lesson One. The following may be used as the first lesson in phonics, and may be called the *Sharp Ears* game.

Teacher. Now we are ready for the game! I want to see who has sharp ears, so I shall say a word very s-l-ow-ly, and then someone may tell me what I said. I am thinking about something in this room; I hope some one will touch it. Who can touch some *ch-a-k?* (Repeat the word several times, blending more and more, till at last the slowest child can hardly miss it.) May and Dan and John may go quickly and touch *ch-a-k!* Tell what it is!

The children run lightly and hold up pieces of chalk. In the same way bring out the words, *wall*, *book*, *door*. This concentrates the attention of all upon one object, but only a few have had the pleasure of doing something, so add this:

Teacher. Everybody can touch this if their ears are only sharp enough to hear what it is! When I say "Ready! Touch your *l-i-p!*" "Ready!" (Some promptly lay a finger on the lip, others imitate.)

Teacher. Now touch your *t-o.*

Then, after all have done it, comes the question: "Who can *do this? Cl-a-p.*"

"Tommy may do it; Jessie; Ruth. Now all *cl-a-p!*"

"Who can *sk-i-p?* This whole row may try. Stand! Ready! *sk-i-p!*"

The teacher must decide whether the children are too timid to clap, skip, etc.; also whether it is better at this time to have the pupils repeat the words slowly, or to wait a day or two.

15. Suggestive Lesson Two. This lesson may be used in associating sounds and symbols.

Teacher. There is a little boy named Billy, and he lives in the country and has lots of pets. His cousin Belle came from the city to visit him. When he went after the cow, he took Belle, and Carlo, the dog, went too. The cow was waiting at the pasture gate, and when she saw Billy she said, *m-m-m* (give the sound). Let me hear you say *m-m-m.* I

will write something on the blackboard to help you remember it; when you see this *m*, remember what the cow said.

On the way home, Carlo began to bark, and bark, at something! When Billy and Belle came closer, they saw it was a black snake, coiled up, and it said *s-s-s*. "Come away, Carlo!" cried Billy, "papa says that kind of a snake does not hurt anybody!" So Carlo left the snake and ran on with Billy and Belle. This *s* will make you think of what the snake said. All say it: *s-s-s!*"

While the children were gone, Billy's mother put some bread and bones on Carlo's tin plate. The cat saw it and thought it was good. So when Billy and Belle and Carlo came, there was the cat eating Carlo's supper. My! Carlo ran to that plate, and he growled, '*r-r*," as if to say: "What are you eating my supper for?" The cat sprang away, arched her back and said, "*F-f-f*," as if to answer, "There was such a big plateful that you might give me a *little*."[1]

(The teacher writes *r*, *f*, *m* and *s*. This may be divided into two or three lessons, if preferred. The lesson is much more effective if pictures of the cow, dog, cat, etc., each saying its own letter, are shown. *New Education Readers*, Book I, has a series of such pictures. The series is published by the American Book Company.

16. Suggestive Lesson Three. This lesson is not the third in sequence; it may come a week after the second lesson. It should be used in introducing the vowel and family names.

The vowel used may be a child's initial, as *A* for *Alice*. *A* stands by *m*, and we have *am*, then *r-am*, *S-am*. Or, without any reference to the Billy and Belle story, the teacher may write *i* on the blackboard and say, "Let's call this a little boy, throwing a ball in the air. Can you make his picture as I have? Let's play this little boy says *i* (give short sound of *i*). Here is another picture, *t*. We will call this a tall soldier with his gun on his shoulder. He says *t* (give sound of *t*). Now the little boy and soldier take hold

[1] The story of Billy and Belle is modeled after the *Frank and Fannie* story in Book I of *New Education* series.

of hands like this, *it*. I wonder what they say together? Listen! *i-t, it*. All write it. I will write it — *it, it, it, it*— four times. Now I will put *m* here, then *s*, and *f* by the others, and now we have, *it, m-it, s-it, f-it*.

From that day forth, do not let a day pass without blending some familiar sounds into a written word. The story of Billy and Belle may run on till it brings in most of the alphabet and some special sounds; for instance, Billy and and Belle met a flock of geese, and one stretched its long neck, put out its tongue and said, "th-th" at Belle. (This is the sound of *th* heard in *thin*.)

However, by the time a dozen or more letters are learned through the stories, or initials, the pupils will have grasped the idea and can take and retain many sounds without the aid of a story. Just tell them what *oo* says, and weave it into words like *shoot, moon*, etc., and they will remember it.

The Aldine Chart gives pages of families of words.

17. Hand-made Phonetic Drill Cards. A part of the equipment for teaching reading should be the set of phonetic drill cards made to accompany the basal readers in use in any school. If the school authorities do not furnish the cards, the teacher will be wise to buy them herself. In either case she will do well to make one or more duplicates of the set that is bought, for this makes possible a more effective use of them in games. To illustrate: a teacher gaily scattered a score of phonetic cards upon the schoolroom floor, saying, "See how many cards you can bring me." Each child quickly picked up a card that he thought he knew and ran with it to the teacher. If he sounded the phonogram correctly he kept the card and ran to get another. If he failed, he dropped the card on the floor and selected another one bearing a different phonogram. Most of that group of pupils knew only four or five phonograms, but each of the phonograms appeared on three cards, so every child had a chance to find several cards that he knew.

More important than duplicating a set, is adding to it features from the sets of phonetic drill cards which accompany other series of readers, because a little help in the phonic scheme used may be a great advantage in reading a supplementary primer.

The *Aldine* and the *Beacon* Methods, for instance, differ widely in the first steps in phonics. A child trained to read the primer of either series will, in time, readily read the other, but he will do so sooner and with less effort if he has some practice along the phonic lines used in the supplementary book. For that reason the following set of "handmade" or "homemade" phonetic drill cards has been planned to include features from half a dozen or more series of readers. Some things are common to all, a few are found in only one or two. The latter may be introduced whenever the teacher thinks best or may be omitted altogether. The cards should be made of a good grade of manila cardboard. The size is immaterial; cards accompanying three sets of readers are respectively 7 x 9½ inches, 6 x 9 inches and 5 x 8 inches. A smaller size will answer; all that is required is that the phonograms be clear and large enough to be easily recognized by the class. The phonograms may be in print or script, or both.

In one series of readers each phonetic card has a phonogram in print on one side and the same sound in script on the other. Another series has the printed phonogram on one side and a printed type word on the other. A third has the script form of the phonogram under the printed one on one side, and the type word in script and print on the other. The letters may be made with a heavy marking crayon or crayola, or with ink, or some printing outfit may be used. Remember that the suggested order in which the phonograms are placed on the cards is not, most emphatically *not*, the order in which the phonograms are to be presented to the children.

18. Directions for Making. (a) On one side of twenty-six cards (one letter on a card) place the letters of the alpha-

bet, unmarked. The vowels have the short sounds, and *c*, *g*, and *s* the sounds in *cat*, *get*, and *see*. On the reverse side of each card place a corresponding type word, which the child is taught to associate with the phonogram, as *ax* or *apple* for *a*; *bat* or *ball* for *b*. Choose as types familiar words which are usually pronounced correctly. Thus, for short *e*, *egg* is familiar, but in some communities it is pronounced *aig*, and in that case some other word should be used. Preferably the phonogram should be the initial letter of the type word, but with *x* and some sounds of *c*, *g*, and *s* this is not possible, so *fox*, *face*, *page*, and *is* may be selected.

(b) On three more cards place *c*, *g*, and *s* separately. The difficulty of teaching the "second" sound for each, may be met in one of three ways:

(1) Mark the letters as some dictionaries do *c*, *g* and *s*, but do not use the marks in the type words *face*, *page* and *is*, which appear on the reverse side of the cards.

(2) Beside each letter place in parenthesis that other letter which has the same sound and which some dictionaries use in re-spelling instead of marking words, as, *c* (s), *g* (j), *s* (z). Such dictionaries show pronunciation thus; *face* (fās), *page* (pāj), *is* (iz). The purpose is to impress the child that those letters have *two* sounds, one being that shown in the parenthesis.

(3) Instead of two cards each for *c*, *g*, and *s*, place two type words illustrating the two sounds upon the reverse side of the first card, that is, on the reverse side of the card bearing *c* place $\begin{cases} cat \\ face \end{cases}$; on the *g* card place $\begin{cases} get \\ page \end{cases}$; and on the *s* card place $\begin{cases} see \\ is \end{cases}$

The trouble lies in the language. No letter should have more than *one* sound. *C* has no sound of its own, being either *k* or *s*; *ck* should be placed on a card and the fact brought out that *k* and *ck* have the same sound.

(c) The combinations *th*, *oo* and *ow* may each be either represented by two cards, on one of which the phonogram

is marked *th*, *ōō*, *ōw̄*, as suggested in (*b*), (1); or by one card bearing two type words as in (*b*), (3), thus; *th* {*thin* / *then*}; *oo* {*room* / *took*}; *ow* {*cow* / *low*}

(d) On eleven separate cards place *sh*, *ch*, *wh*; *oi*, *oy*, *ou*; *ar*, *er*, *ir*, *ur* and *or*, with their type words respectively; *shop*, *church*, *whip*; *oil*, *boy*, *out*; *car*, *her*, *sir*, *turn*, and *fork*.

(e) For drill on the effect of *final e*, place on four separate cards the phonograms, *a - e*, *i - e*, *o - e*, *u - e*, with type words like *slate*, *kite*, *cone*, *tube*.

(f) To show other combinations which have the same effect as *final e*, that is, to make a vowel say its own name or long sound, place on five separate cards, *ai*, *ay*, *ee*, *ea*, and *oa* with such type words as the following: *rain*, *play*, *beet*, *meat* and *goat*.

Note. (*e*) and (*f*) should be emphasized by blackboard practice on pairs of words like *slat*, *slate; kit*, *kite; con*, *cone; bet*, *beet; met*, *meat; got*, *goat*.

(g) Upon two separate cards place *ing* and *ight*, with the type words *sing*, *sight*.

(h) The preceding seven groups of cards contain the most important phonograms; from them innumerable "families" may be formed and taught as wholes, like *ing* and *ight*, according to the plan of the *Aldine* and other methods. Or the *Beacon* plan of tying a vowel to the initial consonant sounds may be introduced, with corresponding practice upon such forms as *di-d*, *di-g*, *di-m*, *di-n*, *di-p*, *di-sh*, and *da-m*, *de-n*, *do-g*, *du-g*.

(i) One series of readers gives drill upon compound phonograms, as, *bl*, *cl*, *fl*, *gl*, *pl*, *sl; br*, *cr*, *dr*, *fr*, *gr*, *pr*, *tr; sm*, *sn*, *sp*, *spr*, *st*, *str*, *sw*. These may be placed upon twenty separate cards with type words upon the reverse side of each.

(j) These twenty cards may be *Beacon-ized* and multiplied by "tying a vowel sound to each," giving *bla*, *cla*, *fla*, *ect*, *ble*, *cle*, *fle*, etc. (short sounds of the vowel).

(k) Some sets of drill cards contain phonograms which are used as final syllables; thus eight cards may be made bearing *dy*, *fy*, *gy*, *ly*, *ny*, *py*, *ry*, *ty*, with the type words respectively:

can	*dy*	glad	*ly*	cher	*ry*	taf	*fy*
six	*ty*	bug	*gy*	pup	*py*	pen	*ny*

(l) Some sets even give such endings as *ness* and *ful*, which are used in *glad-ness*, *care-ful*, etc.

Wisely used, phonetic cards aid the pupil by giving pleasant variety, and aid the teacher by relieving her of much blackboard work and saving her time and energy during school hours, for the cards may be prepared during the summer vacation or on Saturday. Indeed, phonetic drill cards are so well worth while that they should be considered indispensable.

TEST QUESTIONS

1. Give three reasons for beginning the teaching of phonics in the first grade.
2. Of what value is a knowledge of diacritic marks to the teacher? Do you thoroughly understand these marks?
3. What are the chief difficulties to be overcome in teaching phonics to beginners?
4. What is a phonogram? A word family?
5. Show how games can be used for teaching phonics in the second and third grades.
6. Should phonic drills be given in connection with the reading lesson? Why?
7. What pictures besides those found in this chapter can you use for interesting your pupils in phonics?
8. What relation does syllabication bear to phonics?
9. Show how drill in phonics assists foreigners who are learning to speak English.
10. Write out a plan for using phonetic drill cards.

CHAPTER THREE

HENRY G. WILLIAMS, A.M., Ped. D.

Managing Editor, "The Ohio Teacher," Columbus, Ohio

METHODS OF TEACHING ARITHMETIC

INTRODUCTION

1. Purpose. It is very essential that the teacher have a clear, well-defined aim as the goal in every effort she puts forth in the teaching process. Too much teaching is aimless, in the sense that the teacher is not quite clear on these important points:

(1) What should be the ultimate aim, or final result, of the lesson to be presented?

(2) Is the lesson to be presented suited to the mental capacity of the pupil to be taught?

(3) Is the particular lesson, or fact, or principle, the one which the pupil needs to learn next — does it have the right sequence when measured by the nature of the subject and by the knowledge already possessed by the pupil?

(4) Does the method of presentation employed by the teacher give due regard to the nature of the topic to be developed, or presented, to the mental equipment and grasp of the pupil, to the inherent interests of the pupil, and to certain definite pedagogical tests which the teacher must apply to her own standards, materials, and methods?

Teaching is a very complex process and yet it may be directed and tested by means as clearly defined and as definitely recognized as the processes involved in business or industry. The chief reason for so much aimlessness in teaching is attributable to the lack of scientific preparation and training on the part of the teacher, or to the unscientific hit-or-miss supervision given to the teaching, or to both.

While this course in arithmetic does not pretend to be a manual on the science and art of teaching, for the obvious reason that the subject of arithmetic is but one of many branches comprising the curriculum, and for the further reason that a somewhat comprehensive knowledge of the science and art of teaching must be pre-supposed as the equipment of every teacher before she can hope to apply the principles of teaching to her methods, yet it has been the aim of the writer to stress *method of presentation, the selection of proper subject-matter, and the sequence of topics* in such a way as to insure growth and development of the pupil's knowledge.

2. Criticisms. The schools will always have their critics, but perhaps no subject taught in the schools has been the source of more criticism than has arithmetic. It must not be forgotten that all these critics have passed through the schools. They are now the editors of our daily, weekly, monthly or other periodicals; they are now the writers of our books; they are now the ministers in the pulpits; they are chiefly men in business, industrial and professional life.

They say that pupils who emerge from the schools today are not nearly so well prepared in arithmetic as were pupils trained a generation or so ago. Such critics usually assume an air of positiveness that brooks no argument. The fact is that the average pupil who has passed through the elementary schools within recent years knows more arithmetic than did his father at the same age. This is not the place to submit proof of that statement, but it is perfectly defensible.

(a) Basis for Criticism. The average course in arithmetic, based upon the average text-book or text-books on the subject, taught in the average American elementary school, will produce a better comprehension of arithmetic on the part of the pupil by the time he leaves the elementary school, than ever before in the history of American education. But there are several elements in this criticism that must not be overlooked:

(1) The four fundamental operations are not now taught as early in the course as formerly; hence, children who leave the schools before having completed the fifth grade, often know less of the applications of arithmetic than their parents did at the same age; but they have been taught a good many other things their parents never knew.

(2) The average adult is unable to measure accurately, through the memories of a quarter of a century, just how much of what he now knows was gained in the schools and how much was learned in the school of experience since he left the prescribed school. Such comparisons are usually unfair and often actually untrue.

However, there is a fair basis of criticism. If pupils emerging from the schools today do not know as much arithmetic as they *need to know*, or if they do not know the *kind* of arithmetic they need to know, then there is just ground for criticism and ample reason for such a re-adjustment of our courses in arithmetic and improvement in our methods of teaching it as will, in a fair measure, satisfy these demands. In the following pages much will be said about subject-matter suited, on the one hand, to the interests and comprehension of the pupil, and, on the other hand, to his life interests, to the civilization into which he is born.

(b) Factors in the Problem. But who knows infallibly just what a pupil should know at any given stage of his mental development? Have we any standard of measurement by which to determine the relative values of problem-material that lends itself not only to arithmetical

process but to the elements of growth on the part of the learner? Here two mighty factors come to our aid:

(1) Our knowledge of the child and the processes in his mental and bodily growth is far from complete. This science of the child is of recent development and is only yet in its infancy, but we know enough to know that the schools should have to do with his growth and development in more ways than the one formerly considered the only legitimate field for the school's activities — intellectual growth. We know now that there is a physiological aspect to his education, and in this sphere physiological laws cannot be ignored. We know there is a biological aspect to his growth and development, and we must listen to the teachings of biology. There is also a sociological aspect, and even in the teaching of arithmetic this aspect cannot be ignored. There is a psychological aspect, and the laws of mental growth and development must be obeyed at every step. Then there is the philosophical aspect of education which must be considered in the shaping of the individual's character, individuality, philosophy of life, attitude toward truth, justice, law, order, duty and destiny. These matters cannot be safely ignored in shaping a course of study. We are what we *are* very largely because of what we *do* — our conduct — and our conduct is influenced tremendously by what we know, and what we know is predicated very much upon what we have been taught, and what we have been taught came through the course of study — the mandates of society as to what its successors should know, and do, and be.

(2) This leads us to consider briefly the second factor that comes to our aid to show what we should teach in arithmetic, and, to some extent, how we should teach it. We refer to the demands of society — the decrees of experience. It is true that popular opinion, or the public will, or the demand of society, is not always right, but the school is a social institution, growing out of the apparent needs of the social whole; hence its creature. The school

cannot advance much beyond the will of society, nor can it recede very far behind the will of society. The human mind is so constituted as to sanction those changes in our civilization which affect our mental, moral, and social life more than those affecting material matters. The very soul of man adapts itself less readily to changes in our spiritual adjustment than to those of material concern. For this reason, we are much more conservative in matters of religion and education than we are in science, or industry, or agriculture. A man will give up an obsolete method in manufacture, or in the cultivation of the soil, much more readily than he will yield a belief or an ism. This principle in man's nature accounts for the tenacity with which he will cling to the method by which he was taught. It accounts for the destructive influence of tradition in education. A farmer will gladly give up the sickle or the grain cradle for the self-binder or the header, even if he must lose practically all he has invested in the obsolete implement, but he will insist on seeing no reason why his son should not be taught spelling and reading and arithmetic in just the same way as he was taught them.

In other words, although some leaders of society may recognize the imperative need of a new curriculum in arithmetic, and of new methods of presenting it, to prepare the youth of today for the civilization of today rather than for that of yesterday, there will always be a very noticeable backward pull, due to this reverence for tradition and the mental disposition to resist changes other than those affecting natural things, such as one's income, taxes, etc. The school cannot very far outrun society, although it must be the leader; the spokesman; the vanguard.

3. Changes Demanded. In recent years, society seems almost to have outrun the school. Society sometimes wants the school to do what seems too radical; too far ahead of present needs. Out of this present condition of restlessness on the part of society, have come many severe criticisms of the schools. They are said to be neglecting the so-called

practical things for the sake of theories and isms. Society often says there are too many fads and frills in the curriculum, and not enough of the plainly utilitarian.

(a) The Committee of Fifteen. The course in arithmetic has been under ceaseless fire for a good many years. In the early 80's a siege of destructive criticism began. The charge was frequently made then, that pupils from the schools could not apply their knowledge of arithmetic to the simplest problems of a practical nature; that the problem material in the texts was poorly adapted to train pupils to think independently and apply their knowledge of number and of operations to the everyday problems; that teachers were to blame for not breaking away from the impractical texts in use, etc. But not much was done of a constructive nature until in the early 90's the National Education Association appointed the "Committee of Ten," one of the prominent members of which was Dr. William T. Harris, later United States Commissioner of Education, who afterwards framed the report of the "Committee of Fifteen," of which he was chairman. The first committee sought to find out what was wrong with our high school courses of study; but found it was necessary to go down into the grades, even to the very first grade, to find the answer. This conviction on the part of this committee, consisting of really 90 men (for each of the ten men originally appointed, except the chairman, was made the chairman of a sub-committee or conference of ten men) resulted in the appointment of the "Committee of Fifteen," whose duty it was to inquire into the needs of the elementary schools in the way of a curriculum.

The "Conference on Mathematics" or sub-committee of the "Committee of Ten" were unanimously of the opinion that "*a radical change in the teaching of arithmetic is necessary.*"

The recommendations of these two committees have had widespread influence in the *discussions* of the subject since 1892; and in recent years text-book writers and text-book

publishers have been yielding to the demands of society for courses in arithmetic that shall show marked and extensive eliminations of subject-matter formerly taught, and the enrichment of the courses by the introduction of much problem-material gathered from the pupil's environment.

(b) Business Men. These prominent educators were not alone in their conviction that the course in arithmetic should be extensively pruned or abridged, for business men very generally had voiced the same demand many years before. Bankers; merchants; contractors; mechanics — all complained that young people who had had the training of the schools were sadly deficient in at least four things:

(1) They were not accurate in their calculations.

(2) They were not rapid in the fundamental operations.

(3) They lacked, to a surprising extent, the ability to apply principles to actual problems.

(4) They could not interpret the meaning of written problems.

(c) High-School Teachers. A third source of complaint came from high-school teachers, who said the freshmen were unable to make satisfactory progress with their high-school mathematics because they were sadly deficient in arithmetic; could not add, subtract, multiply, and divide accurately; could not handle common fractions nor decimals intelligently; could not interpret problems; could not form mental pictures necessary in order to see relations, ratios, or magnitudes.

4. Time Expended. A critical study of the situation in the 90's, as now in many schools, disclosed the fact that arithmetic often was given more time in the weekly schedule than any other subject of study. The course began in the first grade, continued through the eight years of the elementary school, and was usually reviewed for a half year by the seniors in the high school. The length of time given for *recitations alone* in arithmetic, in the eight elementary grades, averaged 100 minutes a week in each grade; and the study and recitation frequently required one-fourth of the

child's time. Then there was "home work" which often meant that parents were annoyed by having to study impossible problems, and problems that seemed to them at least of no practical value. Was it any wonder that the public, the school patrons, society at large, grew impatient and often rebellious?

(a) Unreasonable Problems. Evidently too much time has been given to the study of arithmetic. This statement seems paradoxical when we realize that the average pupil learns too little arithmetic. There are several very clear reasons for this condition. Children are often required to study abstract arithmetical processes before they are mature enough to understand them and take any interest in them; problems frequently have no meaning to the child because they are wholly out of his range of experience and interest; many teachers and text-book makers have followed the long since exploded notion of the ultimate value of formal discipline.

In fractions, for example, small children have been required to add, subtract, multiply and divide such fractions as $\frac{3785}{7877}$, almost impossible in an actual transaction. In bank discount many problems similar to the following were found in the text-book:

If the rate of discount on a note at a bank was $6+\frac{1789}{9865}\%$, what was the rate of interest?

In alligation alternate this problem tormented thousands of bright boys and almost drove them distracted:

A certain king gave his silversmith 1 lb. 10 oz. 18 gr. of silver, 2 lb. 9 oz. 10 gr. of gold, and 14 oz. 6 gr. of alloy with which to make him a crown. When the crown was finished, the king suspected the silversmith of a theft of a portion of the gold. Given the specific gravity of gold, of silver, and of the alloy and the weight of the crown and its specific gravity, find out the amounts of each metal used by the silversmith.

(b) Mental Discipline. Think of expecting a 13-year old boy to solve such a problem. Yes, he *can* be taught do it, but think how little his interest in such a thing and how much he might have learned that is really worth

while! Even today, we sometimes find teachers who defend such problems on the ground of *mental discipline.* When pupils are required merely to manipulate figures without knowing what the processes really mean, they are exhausting their energies without gaining any desirable results. Even if there should be some disciplinary value in a problem, it has no right to a place in a text-book or in a course of study, if that is all the value it has. There are so many ways in which the discipline may be obtained while other practical and contributory values are also being obtained, that there is no excuse for such a waste of the child's time and energy, and, worst of all, for the depressing effect any exercise has when it cannot be interpreted in experience or interest.

5. Arithmetic not Difficult. When taught at the right time in the right way, arithmetic is really not a difficult subject. In the primary grades, the chief aim should be to teach the child *how* to add, subtract, multiply, and divide. This will involve the use of simple numbers and practical fractions, such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{1}{6}$, $\frac{5}{6}$, $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$. Such a course would also include factoring of all composite numbers under 100. Simple ratios should be taught objectively and then abstractly. This, in brief, *would give the child more arithmetic than one-half of all the pupils in the American public schools ever learn.* Then, in the grammar grades the pupil should be taught *when* to add, subtract, multiply, and divide — the reading and correct interpretation of problems. If a man knows *how* to perform the four fundamental operations as applied to whole numbers, common fractions and decimals, and knows, also, *when* to apply each process in the solution of his problems, *he knows more arithmetic than the average public school teacher knows.* Not a very ambitious program, but a comprehensive one. These principles will be emphasized and illustrated as we proceed.

We have said that arithmetic is not fundamentally difficult to learn. Some teachers may doubt this statement

and even cite their own experiences as children, or even as teachers, in their efforts to master the subject. Most persons who go through the public schools have studied the subject as a separate and distinct branch of knowledge for eight or nine years. Do they spend so much time on any other subject? After one has completed a high-school course and desires to teach, one must attend normal school or college and there spend at least another half year on the subject-matter of arithmetic, to say nothing of a course in the methods of teaching arithmetic. With nine or more years of school life given to it, one could easily imagine that the student had exhausted the subject; but not so. After the same student has become a teacher, he finds he must return to normal school for a summer course in arithmetic. The writer knew a teacher who came to a normal school to enroll for summer work. Her first request was that she be enrolled for a course in arithmetic — the subject-matter, solutions of problems, etc. She admitted that she had taught school for fifteen years, and that she had studied it every year in preparing for examinations. She had "had" arithmetic, yes, for twenty-four years, but she had never had it hard enough to become immune to its annual attacks.

6. Wrong Methods. The main trouble is with the *teaching* of the subject. Our methods are often faulty, or without sufficient pedagogical basis.

(a) The Starting Point. It is more *natural* for a child to count, and read numbers, and write numbers, and calculate numbers than it is for him to read a language or learn history, or to learn literature. The native, inherent interest in a school subject is often lacking, but it is present in numbers because the child instinctively wants to count, and separate, and combine things of a class. The child would not think of counting trees and boys and stones all in one group. The teacher here finds her starting point — the inherent interest the child has in numbers. If this interest were studied by the teacher and encouraged,

it should be just as interesting and just as natural for the child to add from day to day and year to year to his knowledge and use of numbers. It is the clumsiness of the methods employed that often destroys the child's interest.

(b) Too Early Use of Explanations and Analysis. We often make an easy subject difficult, when the pedagogy of nature would suggest that we strive to make a difficult subject easy. We cover up the little grain of truth in a problem by too much verbiage, or too much explanation, or too many *ifs* and *therefores* and *hences*. We want an infant to give us philosophical reasons for these processes. We expect him to be able to express himself in a logical analysis, by some so-called hundred per cent method, or oral analysis. We forget that he may even know the processes involved and still be unable to explain those processes because he does not yet possess the language with which to express them.

(c) Methods in Other Branches. If we were to pursue the same blind, unpedagogical methods in teaching reading, we should insist that a child should not be allowed to read anything he could not analyze and explain. He should not be allowed to read words whose definitions he could not give. In other words, he should learn to swim before going into the water. If teachers should apply the same rules to themselves, their own mental growth through the use of books would be slow indeed. Psychology teaches us that we first acquire a vast vocabulary through the ear before we have any vocabulary of speech, or vocabulary through the vocal motor process. When a child *begins* to talk he uses his words sparingly and insists upon his right to abbreviate sentences by all sorts of abridgments and omissions. He has a vast storehouse of auditory words in his subconscious vocabulary, but he is able to marshall only a few of them into line so they will come forth as subject and predicate and modifiers. He probably knows several hundred words but only a dozen will yield to his ambition to use oral speech. But the other words stored

away in his subconsciousness are just as necessary to him as the twelve words he uses in oral speech. These twelve words could not have their proper meaning without their *association* with the other words of his auditory vocabulary.

(d) Enthusiasm Crushed. This can often be said of the child's knowledge of number. We crush his enthusiasm to learn by insisting too early on reasons, definitions, processes, analyses. The subject which should be fascinating to him soon loses its grip on him and he learns to dread his "sums" because he knows he can't give "explanations" that will pass muster with the teacher. Suppose the teacher herself were to be called upon by the superintendent at any unguarded moment and be required to give the "meaning" of every word she reads, or even the meaning of every word she uses. The meaning is made clear by the "company" the word keeps, not by its study in the dictionary. Thus we learn to know the meaning of almost every new word that comes into our vocabulary. If we would use the same principle in teaching arithmetic, we would often find the child's interest growing instead of waning.

(e) Arithmetical Processes Needed. We want to exercise his mind in arithmetical processes rather than in the logical processes. If he ever learns long division *so it will stay learned*, it will not be so much because he has learned some rule for placing the quotient, or a rule for pointing off the quotient, but because his mind has followed a given path often enough to render the operation perfectly smooth, painless, and unerring because of its automatic nature. The teacher must know *when* to require the reasons for things and the explanation of processes, and when to be content with accuracy and speed of performance. We shall make this point clearer as we proceed to outline the course of study in arithmetic in its relation to the methods to be employed.

7. Why Teach Arithmetic. Every teacher should be familiar with the history of the development of this subject.

She should understand the origin of arithmetic and be able to trace its evolution, the introduction of various topics, the elimination of certain others, the introduction of the various signs and symbols, and the nature of the text-books and courses of study in this branch, from the earliest schools to the present. Such a discussion properly belongs to the history of education; and the wide-awake teacher will prepare herself for an intelligent discussion of all those subjects. Such a knowledge is for the teacher, not for the pupil; and yet the teacher who knows the history of arithmetic may arouse much interest on the part of the pupils by her skilful use of such knowledge. For example, do you know the origin of the "digits," why and when they were first so called, when, and how our figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 came to assume their present form? Why do we make 10 the basis of our notation? Why do 10 units and not 8 units make 1 in the next order? Has it always been so? Do any nations now use any other than the decimal basis? Where and when did we get our $+$, $-$, $\times$, $=$, $\div$, $\sqrt{}$, $\sqrt[3]{}$, etc. Did they all come into use at the same time? Suppose it required 6, or 8, or 12, units of one order to make 1 of the next higher, what would 648 be by each system? The teacher needs to know these things in order to make more interesting her explanations of processes.

However, this great truth must not be lost sight of: the actual world of business is one of abstract calculating requiring reasonable speed and unerring accuracy. The banker deals with figures in the abstract and the *sums* must be absolutely accurate when the books are closed every night. The engineer is not concerned so much with the beauty of curves as he is with the exactness of results, obtained by the use of abstract numbers without any immediate relationship to their concrete meanings. Trial balances do not depend upon the ethics of a transaction nor upon the reasons for "carrying" or "borrowing," but upon the beauty of exactness in an exact science. There are no assumptions nor hypotheses in arithmetic. The poetry of

arithmetic is found in its unerring truth — unerring always. Whenever it is not unerring, it is not arithmetic.

In general, we may class all reasons for teaching arithmetic under two heads:

(1) We teach it because it is useful to every one, no matter whether he is to follow a profession or be a day-laborer. Its practical or utilitarian value is universal.

(2) Arithmetic possesses a high disciplinary value, because it gives a training that no other subject can supply. This may be called its cultural value. The cultural value is perhaps not so high as some of its most ardent advocates claim for it. The doctrine of mental discipline has been very largely set aside through psychological studies of the subject of mental growth. However, while this is not the place for a discussion of the subject of formal discipline, we insist that arithmetic possesses a peculiar value as a means of mental growth that cannot be supplied by biology, or history, or linguistics, or art.

In arithmetic we train for a type of accuracy unknown in science or languages. It is an absolute accuracy of operation. Arithmetic never admits an hypothesis, nor an approximation. There is no "about" in arithmetic. We seek a higher standard of accuracy in this subject than in any other. Then arithmetic develops analytic reasoning as no other elementary subject can. Plato pointed out this fact twenty-six centuries ago. This accuracy and this analytic reasoning are two of the great cultural by-products of the study of arithmetic, and in themselves would go a long way to establish justification for teaching the subject, not to mention the even more evident benefits that accrue through its utilitarian value.

8. How Much Arithmetic. How much arithmetic is actually needed by all people not actually engaged in a business or a profession? By this question we mean to call attention to the fact that only a small percentage of people ever need to perform very difficult arithmetical operations. Those who expect to become teachers should, of course,

become very proficient in this subject. Those who expect to engage in any scientific or mathematical pursuit, such as physics, or engineering, should be thoroughly taught elementary mathematics. Contractors need to be accurate and speedy in their calculations, but seldom do they need to know how to handle complex fractions, annuities, life insurance, partial payments, aliquot parts, alligation, compound proportion, compound interest, and a score of other topics often taught under the name of arithmetic. Bankers and bank clerks are no longer permitted to trust their accuracy in the addition of long columns of figures — the adding machine is much more reliable. Bankers seldom need to multiply or divide, except in the simplest problems. They have no use for mensuration, compound numbers, compound interest, compound proportion, or even of simple proportion. Their interest tables are right before them, and no banker ever has really a very difficult arithmetical problem to solve. The bookkeeper uses very little arithmetic beyond the four fundamental operations. The former does not compute his tax, even when the tax-rate is printed on his tax receipt. The money lender needs no very extensive knowledge of arithmetic — certainly the subject of simple interest or annual interest does not depend in any sense upon any other division or topic of arithmetic than the four fundamental operations and percentage. The physician uses the apothecary's table; the farmer, the avoirdupois; the jeweller, troy; the carpenter, long measure and square measure; the farmer, the same measures — but how many farmers, even college-bred farmers, ever use land measure? The surveyor surveys or measures their land.

(a) Fundamental Operations. We might go on to the end of the list of 367 occupations and professions listed by the Federal government, and we would find that a very small percentage of the people actually use much arithmetic. They all need a thorough knowledge of fundamentals and unerring accuracy in the use of these simple operations. Speed is less essential than accuracy. Add to the efficiency

in the four fundamental operations an equal efficiency in common fractions expressed in halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths; an efficiency in practical decimal computations; an efficiency in the use of compound denominate numbers; a practical knowledge of factoring and cancellation; a dependable method of calculating percentages; a practical knowledge of measurement of surfaces and solids, reinforced by proper visualization — and what more knowledge of arithmetic does the average individual, 95 per cent of the whole, need?

(b) Work of the Primary School. The primary school should make sure of most of the processes outlined above. The first four years of the child's school life constitutes the period during which he must learn *how* to add, subtract, multiply, divide, and factor comparatively small and simple numbers. Here is the place for drill, drill, drill. The child's mind should not be held too long with objective forms in teaching number relations. These are only the crutches upon which he may lean until he learns to walk. Blocks and beans and tooth-picks are not numbers. The child does not add objects, nor subtract them, nor divide them, nor multiply them, nor factor them. They are only *things* for which number stands. Calculations are made in the abstract in the shop and store and mill and on the farm. The processes depend for their clearness upon the proper use of the object and the concrete problem by way of illustration in teaching, but arithmetic is *all* mental — we combine, divide, split, and ratio numbers mentally, and seldom get away from the symbol in the actual process.

(c) Children Leave School Early. Statistics show that more than one-half of all the pupils who ever enter our elementary schools drop out of the educational race before they have completed the sixth grade, and not a very large percentage of them get beyond the fourth grade, or the last year of the primary schools. Notwithstanding the fact that we have compulsory education laws in every state in the Union except four, we are not succeeding in giving

even a majority of our people an adequate elementary education. It is evident that the 11,500,000 children who are today of school age but who have quit school in the sixth grade or earlier, must go through life with only the equipment of a primary pupil. It is also evident that at least 50,000,000 people in this country have had only a sixth grade education or less. But it is a well known fact that millions of people learn vastly more after they quit school than they learned while in school. However, this is mainly true through the means of reading and does not apply so forcefully to arithmetic. Most people learn very little arithmetic after they leave school, unless they be engaged in some profession or occupation requiring almost daily application of fundamentals.

These considerations lead to the conclusion that the ground-work in arithmetic should be thoroughly done before the sixth grade is reached.

(d) Pupils Must Be Interested. The amount of arithmetic a child will learn depends very much upon the interest he takes in the subject, and his interest must usually find its origin in the methods employed by the teacher. With the subject of interest, that of problem-material or subject-matter is very closely related and we want to impress upon the minds of the teachers the basic importance of both.

9. The Matter of Methods. The term *method* is frequently used to indicate some plan evolved by some individual and the "plan" takes the name of that particular individual, such as the method of Grube or Pestalozzi. Sometimes the term is applied to some particular order of presentation or arrangement of material, and we call it the Spiral Method, Ratio Method or Topical Method, One Hundred Per Cent Method, Analytical Method, or Graphic Method. No doubt much good has come from the introduction and promotion of these various so-called methods, but all such writers obscure the most significant factor in the matter of method. We have before us a pile of books — manuals

and texts — exploiting certain methods, each one containing much that is really worth while; but a critical analysis will show that the author has seized upon a device rather than a method, and has enlarged the application of his device far beyond its legitimate function.

(a) Fundamental Considerations. Method in arithmetic, no matter by what name it may be known, should be based upon these fundamental considerations:

(1) A knowledge of the manner by which the normal child's mind grasps and retains number concepts.

(2) The relation of number concepts to sense-perception, and the time and place in which to employ the latter to guarantee the former.

(3) The relation of measurements of time and quantity, and magnitude and value to the abstract symbolism called numbers.

(4) The proper use of objective methods and concreting processes in fixing in the consciousness number relations, or the reading and interpreting of problems.

(5) The selection and distribution of such problem-material as will unconsciously enlist the interest of the pupil, and impress upon him, because of that fact, the problems of his own life and his own environment.

(6) The pedagogy of such devices as may be employed to appeal to the mind that may be sub-normal or supra-normal, in its grasp of numbers and their relations.

The teacher needs to understand the child-mind and particularly the types found in her own school. She needs to study the psychological aspects of number teaching. She should read such books as Dewey and McClellan's Psychology of Number. Dr. David Eugene Smith, of Teachers' College, Columbia University, says:

> The prime consideration in arithmetic is the ability to work accurately, with reasonable rapidity, and with interest, and to know how to apply number to the ordinary affairs of life. To secure accuracy alone, to secure speed alone, to have arithmetic a play-spell without accuracy and speed, or to know how to apply number to life in a slovenly way — these are extremes that we must avoid at any cost.[1]

[1] "The Teaching of Arithmetic."

There are certain fairly well-known principles that should constitute the teacher's creed in the teaching of this subject, and these will be brought out and demonstrated in the pages to follow.

10. Elements of Waste in the Teaching of Arithmetic. For the sake of greater efficiency in teaching and consequently greater proficiency on the part of those who are taught, some one should make a scientific study of the methods employed in teaching arithmetic to discover definitely the elements of waste. We all know that relatively too much time is given to the subject in the schools and relatively too little is learned. Educators very generally agree upon these two conclusions, but when they undertake to get together and actually remove the obstacles to better success in teaching arithmetic, their opinions quite often differ very widely and their ideas as to the diagnosis of the case are often very chaotic when compared one with another. The young teacher with little experience is often left very much at sea as to what to teach and how to teach it.

Briefly stated, these elements of waste are:

(1) Lack of pedagogical insight on the part of the teacher.

(2) Courses of study that include topics of little real interest to the learner or that fail to recognize the principle of sequence in processes.

(3) Problem-material unrelated to the pupil's social needs or unsuited to his powers of comprehension.

(4) Methods of presentation that disregard the child's natural mental processes.

These are the subjects that need to be surveyed scientifically in the schools. Meanwhile, every teacher should institute a little study of her own and seek to discover the sources of waste in her own program and methods.

(a) Scientific Study Necessary. *These elements of waste* should be discovered through a thoroughly scientific study of the whole matter. The methods of teaching should be more firmly rooted in psychological processes and

sociological needs. The subject-matter should bear the closest scrutiny. The study should be made by some man or group of men in sympathy with the idea that education prepares the individual for his future, through a study of and a familiarity with his own life and times, rather than a harking back to what has always been.

(b) Impractical Ideas. It has not been long since one prevailing notion was that arithmetic should begin with definitions, then proceed through notation, numeration, the four fundamental processes, cancellation, factoring, L. C. M., G. C. D., common fractions, decimal fractions, compound denominate numbers, percentage, application of percentage, etc.; each topic belonging to a definite place in the program of grades. Now many of us know that our concrete experiences furnish us with certain problem-material that has a more vital interest than alligation or annuities or duodecimals. The conclusion that arithmetic does not necessarily cover the whole range of problem possibilities "for the sake of mental discipline," has begun to affect our courses of study through the processes of elimination of much matter now thought to be non-essential, and through the introduction of the materials of enrichment.

11. The Problem-Material. What shall we say as to the nature of this problem-material? A "problem" is a question proposed for solution. A problem already solved as an illustration of a type of problem or of a method of solution, may very appropriately be called an *example*.

All arithmetic is really the solution of problems. Of what value is arithmetic to the farmer if he cannot solve his own number-problems? Of what use is arithmetic to the mechanic if he is unable to compute the revolutions of his machine, or the load it will pull? The electrician has his problems; the printer has his; the contractor has his; etc. Whenever we buy or sell or lease or bargain, we must add, subtract, multiply, or divide; and must know not only *how* to perform these operations, but know *when* to employ

each operation so it will apply properly to the solution of our own problem, today, not merely to fit an imaginary problem printed in the book.

Our problem-material, then, must be drawn largely from the actual transactions of those *in adult life* all about us. No one text-book can possibly furnish all the problem-material necessary, not because there cannot be put into the text-book a sufficient number of such exercises, but because the text-book must be more or less general in nature and cannot be based upon *your* community or your own particular time. The teacher must be so trained in the fundamental tests of good problem-material, that she can go out into her own environment, or send the pupils there, to gather concrete problems from the experiences and daily needs of those about them. At the proper time, pupils should be sent to the grocery, or meat market, or department store, or creamery, or factory, or shop, or mill, or farm to make a survey of the daily uses made of arithmetic all about them. They must be trained to set down or write out the real problems they see handled about them, and they should be trained to formulate imaginary problems based upon the real problems of which they or those about them have been a part.

(a) Dramatization. Dramatization is of great value in the teaching of reading and language, because it makes concrete those things that otherwise would be merely words without their corresponding ideas. Dramatization is based upon sound pedagogical principles. It is natural for the child to think himself as other than he is — if he never learned to do so he would have poor chance to become a real man. It is this appeal to the constructive and creative imagination that brings out the best that is wrapped up within us. This principle should be applied liberally to the teaching of arithmetic and to the gathering of problem-material. While such problems are not *actually* real, they are both possible and probable. Text-books frequently contain impossible problems — not impossible in the arith-

metical sense, but impossible of realization. There is no excuse for such problems, to tease and torment the young mind that is actually in a receptive and constructive mood.

(b) Number Games. Closely allied to dramatization is the game we call "Playing Store." Children enjoy it because it deals with real life. Their imaginations are naturally very active and must be fed legitimately or they will find illegitimate food. The child likes to play store or play anything else that puts him in the center of the stage in real life to do the things his father does or other adults about him do. He wants to be a man as soon as possible, because Nature decrees that he should. How can he ever be a man and do the things a man must do in his daily activities, unless he be given a chance to anticipate these activities?

The child not only *naturally* likes to project himself into the future but he *naturally* likes to *do* things. He is not a dreamer merely. He has a profound respect for work and longs to be a worker. The many false ideals erected about him in the home and in society, often wreck this youthful and perfectly natural desire.

Dr. David Eugene Smith, in speaking of the necessity of making the problems more interesting to children, says.

> These problems must be real if they *pretend* to be so; they must relate when possible to the child's daily environment; and they must reveal the life of America today in such a way as to be broadly informational as well as mathematical.

He further says, in regard to the tendency of text-book writers to meet this demand:

> It is out of such a movement, spontaneous but thoroughly sound, that the later American text-books have arisen, and the care and earnestness given to their preparation by various authors and publishers should have the commendation of all. In general these books agree in a number of particulars: (1) Certain subjects, such as the most commonly used operations, should appear several times in the school course; (2) others, such as the business application of simple interest, may appear perhaps two or three times, with gradually increasing difficulty; (3) still others, like board measure, may be sufficiently treated

once for all; (4) the closing year of arithmetic should be devoted to a study of *such higher problems* of business as can be understood by the children.

These are some of the articles of agreement, and they go to show the common sense principle on which our modern courses of study and text-books in arithmetic are based.

12. Sources of Problem-Material. The average teacher who has read thus far is ready to say: "That sounds all right, but how am I to secure problems that do really fit into the activities of the adults of my community? Will the fathers and mothers furnish me their own real arithmetical problems? Don't they already feel bored and annoyed by 'home work,' 'farm surveys,' 'community problems,' 'rural up-lifters,' 'school credits for home work,' etc.? Why should I not rely upon the material in the text-book, supplemented by the problems found in supplementary texts?"

(a) Text-Books Not Adequate. Just as no author of a first reader can exactly fit the needs of the vocabulary of your pupils — a particular group in an individual setting — so no author of an arithmetic can exactly predict the kind of problem-material your particular community will need. Communities are not universally similar, but universally different. We are speaking now in particular not of the abstract number operations, but of the concrete — those that grow out of our experiences. While the fundamental operations must be practiced in the primary grades as mental operations, automatically performed and very largely dissociated from measures of value or volumes or space, arithmetic would fail of its functional value if the pupil did not early learn that these operations and relations are necessary and valuable only because they are needed in the solutions of these real problems that present themselves every day in the lives of grown-ups; and children all want to become grown-ups.

(b) Problems of Life-Interest. The children will readily find problems of life-interest when their attention has been directed to the sources of such problems. So

empty has the average text-book in arithmetic seemed until recent years that pupils with difficulty were led to see the particular use of the knowledge they were acquiring; and parents frequently were openly antagonistic to the character of the problems set for their children to solve. However, this is all changing, and in some quarters the tendency has been to rush to extremes. For example, there has been a considerable demand for a vocational arithmetic, a farm arithmetic, a business arithmetic, a mechanic's arithmetic, etc. In fact, all these demands have been met by publishers and we have texts devoted exclusively to these subjects. If the farmer's son needs a large text containing several thousand farm problems, and farm problems only, would there not be just as much reason for demanding a carpenter's arithmetic for the use of and training of the carpenter's son?

The illustration might be multiplied until the application would seem ridiculous. Not all farmers' sons are going to remain on the farm to solve problems involving manures and fertilizers, and hogs, and balanced rations. Yet such problems are of great value.

(c) Value of Practical Problems. They are of great value because they are real, and grow out of the daily throes of civilization. They are of greater value still because they can be verified objectively — they are not book-made problems. The pupils should be led to keep their ears open for these problems as they listen to the conversation of those about them in the home and on the farm or in the shop. These pupils should be taught to keep their eyes open to see the problem growing out of the daily experiences of their elders. Father is a farmer and building a corn crib, or making a gate, or digging a ditch, or plowing a field, or mixing his fertilizer, or fixing a balanced ration for his cows, or selling some hogs, or buying fencing for the farm. There are scores of experiences every day out of which grow problems in which both father and son may reasonably take an interest. Father may be a day

laborer in the mill. His wages are fixed by scale. When he goes to work in the morning, he rings the bell in the big clock in the office, and again when he goes out. Can he compute the amount that the pay envelope should contain on pay day? The merchant is likely to know when father's pay-day comes and he presents his bill, and so do other trades people with whom father deals. Can the son figure out how father is going to meet all these bills with the wages he receives? Father may himself be the merchant. The son wonders why father seems so care worn and why he "figures" so much. Can't the child find problems of life interest here, and problems in which both father and child may have a common interest, although not from the same view-point?

(d) Solution of Problems Necessary. Not only should the pupil be taught for these real problems, but he should be led to solve them. They will be much easier to solve than those in the text-book, not because they are less difficult by their natures, but because they are real and have something to do with the life interest of the pupil. The problems grow out of his father's immediate need. They possess the element of genuiness, hence they appeal to the pupil's interest. When arithmetic is approached in this way, it is not long until the pupil is learning how to weigh and measure, and calculate, and "keep books." In play, the child likes to "make believe"; in work he likes to do real things that older people do, and he wants his tasks to be hard enough to make him try — to draw out with a dare the best that is in him. When the teacher succeeds in attaching the pupil to real life experiences in this way, the most important battle has been won.

(e) Knowledge Necessary to the Teacher. But the teacher must also know where to go to find life experiences that may be expressed in arithmetical language. She must know vocational life in general and particularly the types of vocational activities in the community where she teaches. She must have a practical knowledge that will save her, at

least, from needless embarrassment. She must not give her pupils vocational problems that are absurd or not really informational. For example, a teacher once gave her pupils this problem: "If one horse will eat 3 bu. of wheat in one day, what will it cost to keep a horse in wheat through January and February this year if wheat is worth $4.50 a bushel?" This problem is possible from the standpoint of numbers merely, but not possible from any other standpoint. The teacher must be familiar with the markets or at least know where to get them from the daily newspapers.

Arithmetic is naturally one of the most interesting of all subjects to the pupil, because it deals with realities right at hand. History deals with things that are past and usually distant from the pupil. He can not see, and touch, and experience many of the things of history. Geography deals in the main with things he will never see, and countries he will never visit. His conceptions of the subjects studied in geography are usually inaccurate because the subjects of study were not objects of experiences. But in arithmetic the pupil may actually enter into almost every concrete relationship corresponding to the mental processes involved in the mastery of the subject. If teachers would familiarize themselves with the psychology of arithmetic, there would be no subject in the elementary curriculum more interesting, and the time necessary for a comprehensive mastery of the subject would be greatly shortened. Our methods are usually poor. Our failure to arouse a contagious enthusiasm among our pupils for this most fascinating game, for game it is, is due chiefly to our bungling methods of selection of proper material, and methods of presentation of that material. The fault is not with the child. He naturally loves to count, and measure, and evaluate; and that is all arithmetic is.

The teacher need not stray far from the many good texts in the selection of appropriate materials, but she must have constantly on hand concrete problems so closely

identified with the environment of the school that pupils may never lack for practice. The problem should not only be arithmetical and disciplinary, but it should often be informational as well. Statistics of productions, cost, construction, manufacture, sale, area, population, valuation, transportation, etc., may often be fixed in the mind if presented graphically, or in the form of concrete problems.

By graphical presentation is meant a form of pictorial illustration or drawing that appeals to the eye. It is usually much more difficult to form a correct mental picture of a problem from the words of the problem alone, than it is from the picture or drawing, because the visual image thus formed assists the imagination in constructing the mental picture. This fundamental principle is fully illustrated in the following pages and in the volume dealing with arithmetic in the grammar grades.

13. Adaptation of Problem-Material. No text-book can do all that must be done by way of adaptation. Neither can the course of study map out, unerringly, the subject-matter of instruction, nor the sequence of that subject-matter. The teacher cannot be instructed in advance of her problems, because her problem never fully presents itself until the pupil to be taught presents himself.

(a) The Pupil's Mental Status. The teacher must make an accurate inventory of his arithmetical achievements, and determine what his own mind and environment decree he shall do next. He may be predominately eye-minded. If so, the picture and the drawing and even the real thing itself must be employed in lodging the truth or the process. An actual cube or sphere or corn-crib will be worth more as problem-material than even a picture or drawing; but the drawing will aid him in interpreting the real corn-crib, although he may have it right before his eyes. The reason is apparent: He is distinctly eye-minded and the visualization of the real corn-crib will be deepened, and its mathematical bearings will be more clearly brought out, when he also visualizes the lines showing length and

breadth and height and sees their relationships. He then sees that the corn-crib is really a geometrical figure — it occupies space. But when he is taught to *draw* these lines, rather than merely to visualize lines drawn by some one else, his eye-mindedness is re-enforced by his hand-motor image of the corn-crib. When he adds to all these various methods of knowing a corn-crib, that of actual construction in the building of the real corn-crib, or a miniature one out of card-board, he sees more clearly than ever what the relation of length and height and breadth are to the volume; and volume is the essential basis of measurement of a corn-crib.

(b) The Pupil's Taste. This adaptation must not only apply to the matter of local coloring, but, with even more insistence, must apply to the pupil's power of comprehension and his native interests — his bent of mind. If the teacher has a boy who would rather build engines than solve problems in long division, the surest way for the teacher to do to make that boy hate school and arithmetic, and every thing connected with either, would be to compel him to deposit that toy engine with her; while she, in a very motherly way, tells him she will take good care of his toy engine until school is out next June! Is it any wonder that very few of our inventors ever get their ideas in school? Is it any wonder that there seems so little room for initiative in the ordinary school program? On the other hand, if that teacher would put the boy to work at making an engine, he would soon discover that the wheels need to be *round*; that steam and gas have wonderful *power*; that friction reduces the amount of *power applied* to the load, and scores of other facts he will need outside of his knowledge of engines. Then he will need to *draw* engines and the various parts. He will learn that care, neatness, and accuracy are first essentials. If this teacher would give him some problems about engines, he would be inclined to take hold of them. But how absurd it would be to require prim, delicate little Susie to solve uninteresting problems when

she is much more deeply interested in how to bake a cake or make a dress? There are many problems she will also need to know how to solve, but they will not often deal with engines.

(c) The Pupil's Comprehension. Adaptation to the pupil's power of comprehension is even more important than adaptation to his tastes and desires. Arithmetic is often made the basis of grading or classification of pupils. It is easier and also safer to classify pupils, for purposes of instruction, on the basis of their real power to read, than upon their ability to "cipher." This fundamental error in our systems of group- or grade-classification has grown out of our early conception of arithmetic as a *series of topics*, and pupils who had "passed over" all the topics to and including "common fractions" were supposed to be able to proceed with decimal fractions and enter the sixth grade. In no subject do greater individual differences of capacity show themselves than in arithmetic. It is pedagogically unsound to refuse a child's promotion from one grade to another solely on his failure to pass over successfully all the topics arbitrarily assigned to a particular grade or year. Most people are "born short" in something and, perhaps due to our poor methods of teaching, more seem to indicate this shortage in mathematics than in anything else. Here is where the teacher's skill and wisdom are best exhibited. The problem-material should be well adapted to the needs of the pupil. It matters little if pupils in a given grade have not all solved the same problems; the main question is, does each pupil understand the fundamentals? Can each pupil *read* the problem intelligently?

(d) Conclusion. This discussion could be greatly prolonged, but a quotation from Dr. Henry Suzzallo in *The Teaching of Primary Arithmetic* is germaine to this view:

> The situation today as influenced by existing aims is one of transition, in which old and new purposes mingle with unequal force in giving us a mixed process of instructing American youth in arithmetic.

Old materials and methods still persist, for logical and disciplinary ideals still hold; but the newer regime ushered in by the demands of business utility and social understanding, gains ground. The obsolete, the untrue, the wasteful methods pass from arithmetic teaching; and the pressing, modern, and useful activities and understandings enter. Arithmetic is less abstract and formal as a subject than it was; it has become increasingly vital and concrete with real interests, insights and situations. The grind of sheer mechanical drill decreases in teaching, and a reasoned understanding of relations, in some degree at least, is substituted. Artificial motives and incentives are less frequently used to get work done, and the appeal of live institutions for a quantitive solution and understanding, increasingly asserts itself.

FIRST YEAR NUMBER WORK

14. Introduction. In the preceding pages, we have undertaken to point out a few of the most fundamental considerations with which the teacher of arithmetic must be familiar, not as a knowledge of subject-matter especially, nor as a knowledge of the solutions of difficult problems, but rather as an underlying philosophy. The day has passed when the mere ability to solve difficult and impracticable problems will guarantee a teacher's success in the teaching of this subject. She must be able to see beyond any course of study or text-book, and be able to judge of the wisdom of such a course. She must be able to measure the merits of any particular course or lesson in terms of the ultimate goal or aim.

Fortified with a knowledge of the psychology of arithmetic, the science of teaching, and the aim of education, she will be able to eliminate non-essentials from the daily program, even though she must omit many of the exercises scheduled in the text of the book in the hands of her pupils. She will be able to choose such sequence of topics or lessons as will contribute most to the growth of her pupil's knowledge and power. She will be able, because of such knowledge and training, to measure the individual tastes and capacities of pupils and thus be instrumental, as an unconscious factor in the pupil's growing interest in the

subject, in arousing the self-activity of the pupil through properly selected concrete problem-material suited to his mental grasp and to his environmental needs.

Arithmetic is not merely a string of subjects, as too often assumed by the old-type text-book. Likewise it is clear that no one can map out a definite program of topics for any particular grade. It is not wise to say that the first grade shall include definitely the reading of numbers so far and no farther; the writing of numbers so far and no farther; the combinations of numbers so far and no farther.

15. Incidental Teaching. It is not safe to say that all number work taught in the first grade shall be taught incidentally. The Committee of Ten was inclined to the theory that arithmetic, as a distinct branch in the curriculum, should be shortened by two years, at least, by postponing its formal introduction until the second grade, and by completing it in the sixth or seventh grade. If number is to be taught in the first grade, so they claimed, it must be taught "incidentally." Just what one means by "incidental" teaching depends usually upon the teacher's aim. Do we teach reading "incidentally"? or language? or spelling? Anything that is taught *incidentally* cannot be a part of our *aim*. If the opportunity for the incidental instruction should fail to present itself, the instruction could not be given. However, if the truth or principle thus taught has *any* relation to knowledge previously acquired or subsequently to be acquired, it becomes an essential; and the child's instruction in it cannot be left to a chance opportunity. Instruction must be purposeful. In fact, all instruction must bear direct relation to our aims in education — either to our immediate aim, as a present achievement contributing to the next and succeeding steps, or to our ultimate aim, our final goal, which may be defined as social and economic efficiency.

16. The Number Consciousness. *The number consciousness* is not merely an incident in the mental life of the child or of the adult. Why, then, should we apologize for having

helped the child in the first grade to grasp a few of those simple but fundamental relationships of number, which his very nature demands he should know? The child cannot think without thinking number. He cannot talk without thinking number. He cannot read without thinking number. This is apparent for the very evident reason that number consciousness is a part of his language from its very beginning. He thinks *boy* and *boys*; *one* mamma, *one* papa; *more* and *less*; *little* and *big*; *top* and *tops*; in fact, the very earliest evidences of his thinking indicate that he is unconsciously contemplating magnitude, volume, size, number, space and measures. All this is arithmetic when reduced to the proper language.

17. Why Teach Number in the First Grade. If, during the child's first years of life — that period during which he is attending a very important school, the Great University of Life — he unconsciously, and without the guidance of a teacher and a course of study, is acquiring a knowledge of number which seems to correlate so closely with his daily experiences, shall we exclude from his daily mental food all conscious efforts to enlarge his conceptions of number and number relations? During the first six years of his life his instruction in number has really been "incidental," except for the efforts of his playmates to teach him the game of marbles and other like accomplishments, and for the longings of his own soul when he seeks information in order to be able to count or play games, or play store. In these two instances the instruction was purposeful and not incidental.

(a) Compared with Other Branches. Shall we now, when the child enters school at six or seven or eight, push his instruction and training in language and drawing and music and nature study and allow number to be taught him incidentally, or perhaps accidentally? Think of the possibilities in his acquisition of a vocabulary without more than merely an incidental knowledge of number? How is he to make any perceptible progress in drawing without a

corresponding growth in his ability to use number? He needs here a knowledge of form, magnitude, distance, proportions, etc., else his knowledge and skill in drawing will be superficial and inaccurate — merely "incidental." The same is true of everything he undertakes, because number is one of the basic elements in thought, in language, in experiences. Dr. William T. Harris used to say that number is next to language in basic importance, if not perhaps equal to it, and that it was so necessary in language that the two could not be separated in the processes of acquisition.

Many teachers have accepted the suggestion made by certain writers that number should be excluded from the first grade and perhaps from the second grade. Dr. David Eugene Smith says that the novelty of the suggestion is, to many teachers, sufficient to create a following. He further says, in *The Teaching of Arithmetic*:

> Shall we leave it to the ordinary teacher to bring in incidentally such number work as he wishes, or shall we lay down a definite amount of work to be accomplished and assign a certain amount of time to it? And, in answering these questions, are we bearing in mind the average primary teacher throughout the whole country? Are we also bearing in mind that arithmetic was never taught to children just entering school until about a century ago, and that it was largely due to Pestalozzi's influence that the subject was ever placed in the first grade? When, therefore, we advocate having no arithmetic in the first grade, we are going back a hundred years or so, which may be all right, but which is not a new proposition by any means.
>
> Having thus laid a foundation for an answer to the question, it is proper to proceed dogmatically, leaving the final reply to the reader. Not to put arithmetic as a topic in the first grade is to make sure that it will not be seriously or systematically taught in nine-tenths of the schools of the country. The average teacher, not in the cities merely, but throughout the country generally, will simply touch upon it in the most perfunctory way. Whatever of scientific statistics we have, show that this is true, and that children so taught are not, when they enter the intermediate grades, as well prepared in arithmetic as those who have studied the subject as a topic from the first grade on.
>
> Furthermore, while it is true that the essential part of arithmetic can be taught in about three years, it cannot, for psychological reasons, *be as well retained* if taught for only a short period. The individual

needs prolonged experience with number facts to impress them thoroughly on the mind. We can, for example, teach the metric system in an hour to any one of fair intelligence, but for one to retain it requires long experience in its use.

(b) Important Tests. If the child in the first grade is to be taught language, drawing, music, reading, history, nature study, writing, spelling, physiology, hygiene, and perhaps other requirements of the course of study, what is the logic in leaving number to a treatment termed "incidental"? There are two very important tests of what should be taught in the first grade, or any other:

(1) The child's taste for number will show whether he is mentally capable of studying the subject at this age. In the Binet test of mentality, no subject is more unerring in pointing out the degree of mental strength possessed by an individual than arithmetic. The *Curtis tests* also make conclusive the fact that the number sense is so basic that classification of pupils may be even largely determined by such tests. The normal child takes as much real delight in his "problems"— counting, combining, dividing or grouping objects — as in anything else which the ordinary school program presents to him.

(2) Not only must we adapt the subject presented to the tastes and capacities of the child, but we must ascertain whether he needs, at this time and in this place, the knowledge we desire to have him acquire. To answer this first question correctly, the teacher needs to have a working knowledge of psychology, and particularly of child psychology. To answer the second one, the teacher needs a knowledge of sociology and a good measure of common sense. If the pupil is a foreign-born child, or comes from a home in which the English language is not spoken, no doubt the emphasis must be placed upon the acquisition of a knowledge of the language — how to use it. If the school is composed of children who have had from one year to two years of work and training in a kindergarten, that fact would greatly modify the course as well as the method.

18. The Allotment. The most difficult task in the construction of a course of study is the allotment of specific things to be done; definite starting and stopping points; the measurement of such boundaries as will avoid too much overlapping, and, at the same time, leave no leaks due to inarticulation. This task is difficult because it is practically impossible to fix such boundaries. Such an undertaking would be wholly unnecessary were it not for the fact that pupils must be taught in groups. If it were possible to instruct pupils individually, it would neither be necessary nor desirable to block out the work by years or grades. The average course of study is constructed to meet an artificial situation due to an economic condition, forcing upon the school group-instruction. For this reason, the course of study, or allotment of work to be done by the pupil, must be a standard for the *average* pupil — not for the strongest nor for the weakest.

If the course of study is not administered by a wise teacher, the strongest pupils of the class will be taught to dawdle and take matters less seriously than they should, because the work is too easy to try their metal or tease them to rivalry. Likewise, and for the same reason, the weakest pupils will be constantly stepping beyond their depths and the accumulation of lessons unlearned from day to day or year to year will become such a load of debt upon their shoulders that they will sooner or later, generally sooner, conclude that the race is not worth the struggle, and so drop out. Let us not forget that it is usually the *average* pupil who keeps the standard of achievement for the race at a low rating. It is not the average pupil who makes the man of greater force and efficiency; there are too many of them to become leaders. The slow pupil more frequently makes a success of life than the average pupil, chiefly for the reason that the slow pupil is usually not slow in everything. His shortage in arithmetic is usually made up by more than average aptness in something else.

At best, the course of study can be but a syllabus of suggestions as to the minimum and maximum that should serve as measuring units for the teacher. No one can safely say that all pupils should learn the fundamental operations within a given time, and fractions within a given time. However, we can be fairly positive as to the *order* in which these things should be learned, and the methods that may safely be employed in instruction.

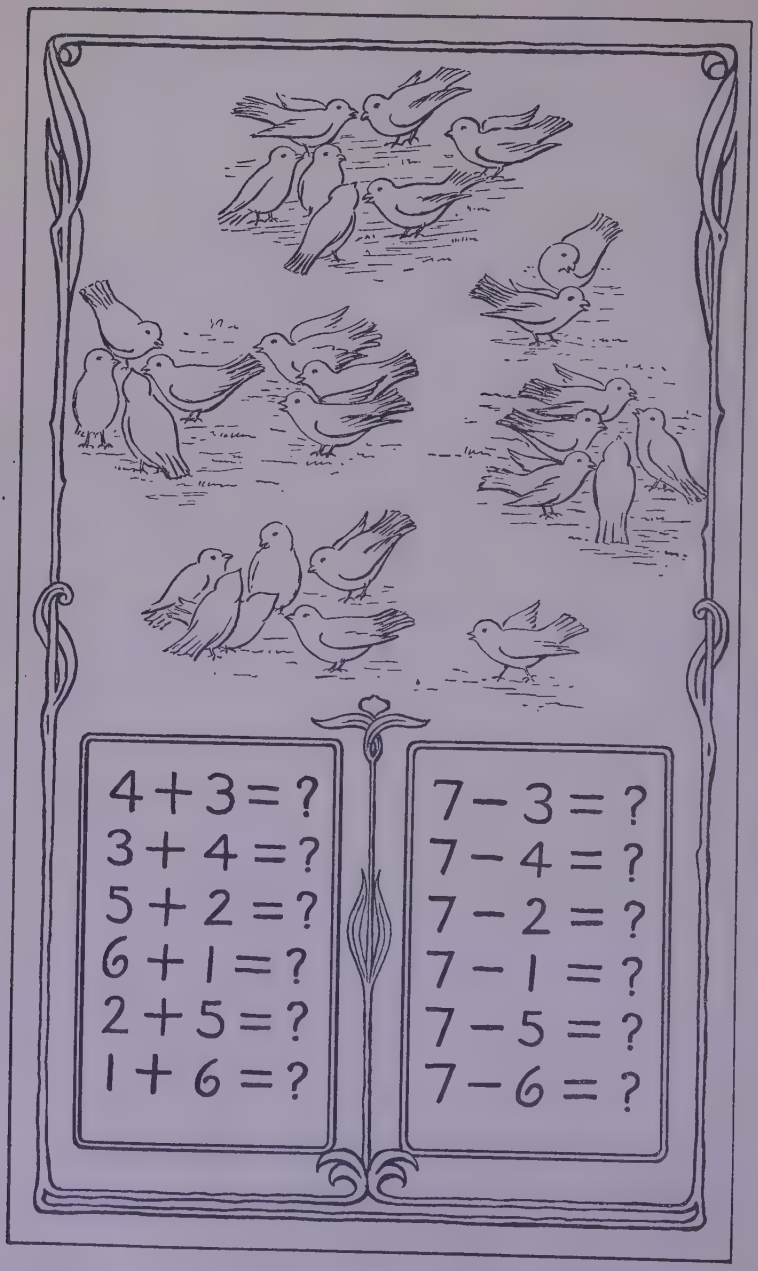
19. Psychological Principles. There are several psychological principles that may be employed in the first year with some degree of assurance of their soundness. A primary teacher who understands child psychology, on the one hand, and, on the other, the rightful demands of society upon the school, will not go far wrong in allowing herself to be guided by these principles, even at the risk of an abrupt deviation at times from a prescribed course of study.

(a) Origin of the Number Concept. She must understand how the number concept originates in the child's mind — it is certainly not inborn. Of course, the most primitive people we know anything about, seem to have had the number concept, but always through necessity. Only in cases of organized efforts of instruction, such as afforded by schools, has the concept of number been developed beyond the most primitive necessity. So far as we know, man is the only creature that can count. He is the only creature that has the ability to acquire an articulate language. He is the only creature that has a tomorrow. The language he employs is artificial, and number is merely a part of language. Both grow out of the mysterious spirit that makes man *man* rather than *brute*. Then, while the ability to count is peculiar to man, he would never learn to count very far were it not for the inborn ambition, or aspiration, that is constantly kindled by his pride in achievement. The small child, even though he can talk, has not yet learned that there is any difference between two objects of a kind and five objects of the same kind, except in quantity. Offer him his choice of two sacks of candy

and his decision is not based upon number of pieces but upon quantity or bulk, or colors, or experience in taste. Offer him his choice of two apples or four apples and, if he understands what you want him to do, he will usually choose the larger group. This is not because he understands that four is more than two, but because his childish mind sees more pleasure in the possession of one group than the other. For the same reason, he will rather have a penny than a dime, or will choose a nickel in preference to a dime.

(b) Number an Abstract Idea. Concepts of magnitude and value precede concepts of number. Number is not a property of objects, as color is, or size, but is an abstract idea that is much more difficult to acquire than concepts of attribute or property. Since it is so much more difficult to acquire, the artificial helps supplied by the teacher must be selected upon some scientific basis if waste is not to occur.

(c) The Desire for Grouping. The first real concept of number is shown by the child's instinctive desire to group objects or to divide them. This is his earliest effort to count. He does not say, "one, two, three, four, five, six, etc.," but he first *points* to one object of a kind and then to another of the *same kind.* He may repeat words *representing* number, such as "five," "six," etc., but seldom "three," because "three" is more difficult to articulate. He has acquired, through the sense of hearing, a few words which represent number, but one number word suits his purpose as well as another, with his choice in favor of the easiest for him to say. He has not yet acquired the real number sense, but he has acquired the concept of *individual things* as being separate from each other. He is unable to see why the fourth apple in a row of six apples should have a name different from that of the first apple or the sixth one. To him they all look alike, then why not call them all "one" or "six"? Here is one place for the exercise of patience on the part of the teacher, who is


4+3=?
3+4=?
5+2=?
6+1=?
2+5=?
1+6=?
7−3=?
7−4=?
7−2=?
7−1=?
7−5=?
7−6=?

usually the parent, or a playmate, or the kindergarten teacher, and not the primary teacher. Grouping and counting forms the beginnings which in time lead to such combinations as are shown in the accompanying design.

Nearly all children have already acquired the "counting concept" before they enter the first grade. The teacher of this grade will find it necessary to combat bad habits. While the act of counting is perhaps instinctive, it is chiefly through the language the child hears that he desires to group and separate objects and find terms to express the groups and the processes he has employed. His first process is that of the recognition of objects as one vague whole. His next process is that of separation of this whole into its component parts. His next and last process in counting is the recombining of what he has recognized as separates or *ones*. The first step is observation, the second is analysis, and the third is synthesis. The child begins with a group and ends with a group — but the first group is a mere unit or mass; the second is composed of two or more *ones of the same kind.*

(d) Uses of Numbers Artificial. The functions or uses of numbers are artificial, not natural, hence involve abstract mental processes. The *idea* of number arises from a natural or instinctive desire to measure quantity, magnitude, or distance. These concepts are developed through the child's recurring experiences. He learns by experience that he cannot touch the moon, although he has repeatedly reached out his hand for it. He has learned by experience that a penny is not worth as much as a dime. He has learned by experience that one knife is worth more in a trade than another. He has learned by experience that value does not always depend upon weight or size. An "aggy" may not be any larger than a hundred other marbles he has, but he will trade a handful of common clay marbles for one "aggy." He does not know why, except that experience has taught him that this is the case. Thus the child develops the ideas of value and quantity. It is this

process of analysis and synthesis, followed by the process of synthesis and analysis, that must be developed in the child through exercise and drill. He must have much experience in this quantitative measuring. Teachers often make the fatal mistake of requiring the pupil to *memorize* the tables of addition, subtraction, multiplication and division, making themselves believe they are teaching arithmetic. What the child needs, in the first three grades especially, is concrete experience in measuring — quantitative measuring.

20. Concrete Problems. Children in the first grade need to learn concretely the purchasing power of each of the coins, cent, nickel, dime, quarter, half-dollar, dollar. But immediately when we suggest a dollar, we invite the opposition of teachers who say that they "are not to go to 100 in the first grade!" What a pity! Have you a school savings bank? How long will it require a bright boy to count his money and tell how many dollars he has in the bank? Does he know the relative value of quarters, half-dollars, and dollars? Try him and you will find out. Why? Because this much of counting and combining involves a part of *his* life interest. Will it take a six-year-old boy any longer to learn these relations than it will to learn the language of the game of baseball? Doesn't the boy of six sometimes excel his teacher in his baseball vocabulary? Why? A child will never obtain a clear conception of an acre of ground until he *sees* an acre — until he can experience by his vision what an acre looks like. A yard means nothing to him until he is shown a yard, and is taught how to measure a line in yards—*to count the yards*. So with pints, quarts, ounces, pounds, etc., the child must actually see the quantities measured out, before he can thoroughly understand the relation of one to the other.

We do not mean to imply here that all this is ground to be covered in the first grade, but, we want merely to show that *number arises from quantitative measuring of real things.*

(1) The child *sees* that one boy is taller than another.

He *sees* the height of each in feet and inches. He *sees* that basis of his analysis of numbers and his synthesis of numbers. He *sees* the addition (grouping or group-counting), the subtraction (partition), the multiplication (addition of multiple groups), and the factoring (finding the number of like groups in a composite number). He not only sees all these quantitative relations but at least two other avenues to his mind are traveled in finding lodgment of the number facts.

(2) He *feels* number when he handles objects in counting them; when he uses the ruler or yard-stick in measuring lengths; when he counts eggs with both hands, one at a time in each hand, two at a time in each hand, or three at a time in each hand; when he handles objects that express quantitative relation to each other, or ratio, such as the blocks used in a certain method of teaching arithmetic, in which the idea of ratio is made the fundamental basis.

(3) Not only does the sense of touch reinforce the percepts gained through the sense of sight, but *experience* is necessary to fix these number relations in the nervous system, for unless the child's activities with number do finally result in a lodgment in his nervous system, there can be no reaction, and when there is no reaction we may rest assured the child has not *acquired*.

21. Nature of Mental Acquisition. The nature of a mental acquisition is quite unlike the absorption of a sponge, but more like the charging of a battery hitched to a load—there is bound to be a corresponding expression when the acquisition and assimilation have taken natural channels. So, the child *sees* number, he *feels* number, and he *experiences* number. When the infant cries for the moon and reaches out his hand for it, he *sees* number, but by *experience* he learns it is impossible to acquire possession. When he *reads* in his book that there are twelve inches in a *foot*, he cannot know the kind of a foot meant until he *experiences* it. He must see it and measure it, then express the measure in terms of symbols.

(a) Acquiring a Vocabulary. In acquiring a vocabulary, the child first forms an auditory image of words he hears, long before he can utter an articulate sound; he next learns to form vocal-motor images of the same words by imitation of the sounds made by those who speak them within the range of his ear; he later learns to form visual images of the written or printed symbols representing what were only sounds to him until now—he has started to school and is trying to acquire the difficult art of reading; he next, and lastly, learns to write and print the symbols he has seen written and printed—imitation again—and thus he forms hand-motor images of these same words. He has finally acquired an auditory image of each word in an extensive vocabulary; a vocal-motor image of a much smaller vocabulary, but composed only of words mysteriously chosen from his auditory vocabulary; a visual image of a smaller group due to further selection and reduction; and, lastly, he has acquired a hand-motor image, a writing acquaintance, of a still smaller group. Each of these four images has been registered in a different group of brain cells, but they constitute *four* parts of defense rather than one, and each reinforces the other.

(b) Acquiring the Number Concept. These psychological processes in the art of learning to read, furnish us an interesting parallel in the mastery of any number concept. Why is it that teachers do not more generally see that, in order to fix number concepts in the child's mind, all the possible avenues must be traveled and as many reinforcing images as possible be established?

Then, can we teach number by means of objects only? No, unless number deals only with objects and forms and shapes and sizes. Is ratio the central concept in number? No, unless number is always a symbol of relation. May we teach number abstractly by requiring the pupil to memorize tables of symbols with no individuality, but as purely arbitrary characters representing only mental operations? No, because number is more than the philoso-

pher's sign language. Number in itself is artificial, an invention, but always symbolical of a reality, of a tangible something that may be known to the senses.

(c) Application of Principles. Such being the nature of number, the primary teacher will profit by every suggestion that will help increase the number of images that may be acquired of number, just as in the matter of teaching a beginner to read. But an examination of the methods employed by teachers and by the *teachers* of teachers, shows that we have been handicapping the child by placing him in unnatural or impossible environment; by clogging his mental machinery by useless and confusing verbal description of the "steps" in the "process" his little mind is supposed to be following; by expecting him to construct number concepts entirely outside of the range of his experience—hence, without any hope of adequate reaction. Would you require the child to construct "a soldier's tent" out of "tooth-picks"? In the first place such a *real* object has no counterpart in the child's experience. It is not related to the child's natural reactions. *Soldier* and *tent* and *tooth-picks* are not parts of his image-building material. Here is one place where the teacher becomes a real necessity to the child's growth and progress. No text-book could present material for illustrations nor problem-material that would suit all the needs of any school. The teacher must know whether soldiers or dolls or mud pies or marbles or pigs or chickens would constitute the background of a problem suited to the possible reactions of the pupil.

22. Range for the First Year. If all teachers were ideal teachers and all pupils were ideal pupils, perhaps it would be unwise to fix limits and bounds for each grade. Theoretically, the entire course in arithmetic could be covered in from three to six years—in three years, if the pupil had not been taught too much formal, abstract number prior to the fourth year—in six years if the work could be begun in the second grade. Practically, however, neither plan can be carried out.

By the close of the child's first year in school he should be able to combine and separate numbers to twelve; he should know at sight all possible combinations of two, three, or more numbers to twelve. He should be able to read and write numbers to 100. He should be able to read and write the fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, and comprehend their relations to each other through the senses of sight and touch. He should know the elementary uses of the terms *square*, *circle*, *oblong*, *cube*, *prism*, but should not be required to think them in any sense except to perceive forms and ratios. More natural objects could be used for the same purposes, but oranges are *not* spheres and apples are *not* round. The *terms* square, circle, sphere, etc., are not difficult to acquire merely as the names of certain visualized forms.

Such a program is apparently not a very ambitious one, but there is work enough here to provide a wide range of exercises and drills. This outline can be but suggestive at best and is intended to indicate a minimum rather than a maximum. The teacher should set her goal as a definite achievement, but she should not be prevented from going farther if she should chance to have a class that can go farther with interest and profit. Children must not be *driven* in arithmetic, but their interest must be kept alive. If the teacher finds she has covered this program thoroughly before the close of the year, it would be better for the pupil to continue to make new discoveries than to kill his interest by too much review and repetition.

23. Distinction Between Devices and Methods. In a sense, a device is a method, but it is more frequently an artificial, unpedagogical stimulant which has no direct bearing upon the growth of the pupil's power to comprehend. However, some devices may have the merit of related interest and serve a very useful purpose. For example, do you have difficulty in remembering which months have 31 days and which have 30 days? Learning to name the months on the knuckles is a device, but the writer saw a business man

recently who was apparently counting his knuckles; in reality he was trying to *convince himself* that October has 31 days. Did you ever use the rhyme:

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except the second month alone
Which hath but twenty-eight in fine
Till Leap Year gives it twenty-nine.

That is a device, but if the teacher cannot find a method that will fix in the mind of her pupil the fundamental facts therein set forth, the device has merit.

However, the teacher who is familiar with the psychological processes involved in an act of learning will usually be able to make her methods conform to these principles. The teacher should beware of a "method" that seeks to emphasize but a single idea. In deploring the tendency of teachers to yield to the attractiveness of certain cure-alls or methods in the teaching of arithmetic, Dr. Henry Suzzallo, in *The Teaching of Primary Arithmetic*, says:

> The promulgation and acceptance of such unversatile and one-sided systems of teaching method are indicative of two defects in the professional equipment of teachers: (1) The lack of a clear, scientific notion as to the nature and function of teaching method, and (2) the lack of psychological insight into the varied nature of classroom situations. Untrained teachers we still have among us, and others, too, to whom a little knowledge is a dangerous thing. These are frequently carried away by the enthusiastic appeals of the reformer with a system *far too simple to meet the complex needs of human nature.*

24. Underlying Principles and Courses of Study. The ground to be covered in any given year and the methods to be employed in doing it, must pass muster in their review before the great principles underlying the teaching process. Teachers are not alone in their failure to agree upon a more or less fixed boundary for the course in each school year. School officials who write and adopt courses of study are frequently less fit to do this than the teachers for whom the courses are prepared. It is very difficult for either teacher or school officer to break away from tradition, for

tradition has its value. If we were to cease doing a thing or following a certain course, on the ground that said course has been followed so long that it is out of date, we might by this process wreck society itself.

(a) Precedent. History of educational procedure has its value. Older nations have had longer time in which to test methods. For example, an examination of courses of study prepared by state authorities to conform to statutes, discloses the fact that there is a tendency to follow in the footsteps of older nations in this matter.

(b) New York Course of Study. The New York State Course of Study follows pretty closely the practices in France, Germany, Belgium, Italy, Switzerland and Sweden. The New York State Course of Study in Arithmetic probably covers more ground in the first three grades than any other state course of study, or even more than is included by these older countries. The work of the first grade is not left to be done "incidentally." Here is a brief summary of the course for the first year:

In the first half year, count to 100, read numbers to 100, and write numbers to 100. Of the 45 combinations of two figures in addition into sums not exceeding 9, twenty of them should be memorized the first half year. Oral drills with seat work (written) and blackboard work should include such exercises as these:

2	5	2	4	4	7	2	1	2	3	6	3	7	5
4	2	3	4	4	1	6	8	5	2	2	4	2	3

Memorizing of the sums is urged, and the counting of *two groups of objects* to find the sum is strictly forbidden by this course of study. "Objects should be used only for *consecutive counting*," says the course, "and for developing the *idea of number in the abstract*." The claim is made that by using two *groups of objects* to find the *sum*, the child thinks addition is counting. "Nothing has done more injury in number work than the too long-continued and

injudicious use of objects in its teaching." The drill in the 20 combinations the first half year should be given in such manner as to prepare for subtraction as well as addition. The Austrian method of subtraction is advised. During the second half year, the remainder of the 45 combinations are taught; counting to 100 by 2's, 5's and 10's; drills in the additions of *columns* of figures on the blackboard, no sum to exceed 9; carrying in addition is taught; insist upon much repetition and drill. "Make no attempt to explain the process, this is the time to teach the *art of computation*, not the *science of numbers*.

(c) Points Emphasized. We have quoted at length from this course to emphasize two things:

(1) *Objects* are not *numbers* but numbers are the symbols that stand for the *counting* of objects — hence, all number *processes* are subjective and not objective.

(2) Practically all numbers and number processes are concerning objects, hence we could not agree with the idea that objects are likely to be used too long.

(d) Dangers to Be Avoided. The *injudicious use* of objects, however, is a danger, and we wish to offer the teacher some help along that line.

(1) If the teacher should cling too closely to real objects in counting or if she should continue the method too long, her pupils will fail to acquire sufficiently early, the habit of thinking number, abstractly. In any kind of use of number in the practical affairs of life, we do not form mental images of the relationships of things as separate units, but we think numbers and their relations more as symbols or characters representing groups and relationships of groups of objects of a kind. If we employ apples, or books, or people, as objects to count, we gain less speed in reaching abstract number conceptions than if we employ pencils all of one size and color, or squares on the board or on a sheet of paper, or pictures improvised for the purpose. The reason is quite easy to understand. The child can count pictures of rows and groups of pencils, or dolls, or

houses that are *all alike* more easily than rows or groups of people, or apples, or of real houses along the street.

(2) The element of uniformity is essential. Besides, there is more concentration on the counting of rows or groups of *pictures* of dolls than on counting *real* dolls, no two of the same size, nor dressed alike. In counting the pictures or drawings, there is less to detract from concentration on the visualization of the things counted; the pictures are smaller than the objects and the eye can actually *see* the entire group or row at the same instant, which would usually be impossible in counting real people or real houses.

25. Objects Before Symbols. Real objects must be counted first. The child is taught to count all the *boys* in the class and all the *girls* in the class and then all the *pupils* in the class. But the child must be taught to get away from his crutch as soon as expedient to do so. He soon finds he can count rows and groups of small pictures, or outline drawings representing the boys and the girls, more readily than he can count the real boys and girls in the class. In using the small pictures he can visualize the whole group at once — his eyes thus photograph the group as a unit.

As he counts orally or mentally, he may be taught to make a straight mark for each picture counted. Thus, he counts a row of chairs and marks 1, 1, 1, 1, for each one counted. He is taught to write his marks close to each other, thus ////. Then he may group those marks thus:

/ // /// //// ///// ////// /////// //////// ///////// //////////

one two three four five six seven eight nine ten

1 2 3 4 5 6 7 8 9 10

He should now learn to write these forms of expression on his tablet or on the blackboard, and he must be taught that they are merely *three ways of writing the same thing*. The teacher should drill frequently on the visualization of the words and symbols, skipping frequently from one to another as she points with a ruler or pointer to //, three, 6, seven, ////, 4, etc.,

For these and other reasons the teacher should be skilful in the use of crayon. Text-books should furnish a good variety of suggestions for objects to count or the pictures of objects. Usually pupils who have been taught to use pictures or drawings in their counting, instead of objects, soon reach the fundamental conception that number is an abstract symbol, merely standing for or representing objects of a class, and the operations necessary in thinking these objects.

26. Counting. In giving the teacher at this point a few illustrations of simple counting exercises, it must be borne in mind that with most pupils who enter school at six, it will be unnecessary to employ such simple exercises. However, there will probably be at least a small percentage of each class of beginners who will need this elementary drill. The chief reason for our starting with these simple counting exercises is to impress upon the mind of the teacher the *method* she should employ in proceeding from the concrete thing to the abstract process. Many pupils on entering school at six are able to count to 20, but they have usually been taught to *repeat words* by mere imitation and have not learned to count by *visualization*, and this is very essential to further progress.

(a) Exercises. Draw a row of ten apples:

Have them counted serially — one, two, three, four, five, six, seven, eight, nine, ten. Count from right to left as well as from left to right, the latter being the usual method merely because we read and write from left to right. But we do not always find in actual experience that we count real objects in that way. We learn to count them when they are arranged in any order or in no order. Ask the child to count ten little "biddies" with the old hen, and they are not likely to arrange themselves in a nice straight row for him to count. Let the teacher draw a group of ten

chicks in any order, and then in no order. These are to be counted by ones. Let her draw ten cats, or ten chairs, or

ten oranges, or ten boys, or ten houses. These need to be drawn only with a rapid stroke of the pencil. The child's imagination will supply what the teacher's haste makes

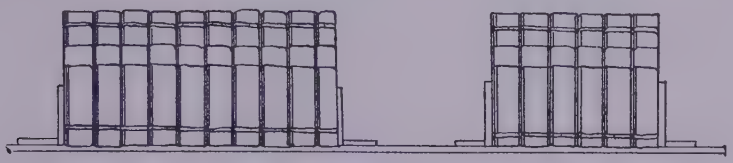
necessary to omit in the way of detail. Such drawings of familiar objects may be arranged as shown in the illustrations.

In counting, it is always best at first to have real objects — all of a kind and as nearly uniform as possible. It is hardly possible to supply the children with much of a variety of objects. As soon as possible, the teacher should make the transition from the *object* to the *picture* or drawing. Here, again, all the pictures must be alike. The teacher should be able to draw quickly on the board a row of flags,

houses, chairs, books, apples, pears or cats. These may be arranged for group-counting or for subtraction as well.

The next step in this visualization in counting, is to count the objects in groups. These pictures of ten oranges, or ten chicks, or ten kittens, or ten chairs, or ten flags, or ten pencils, should now be placed on the blackboard all in

one group, without any special design as to arrangement. For example, a hen and ten chicks should be drawn in a natural grouping. The pupils should learn to count them in this group. The process is more difficult than the counting

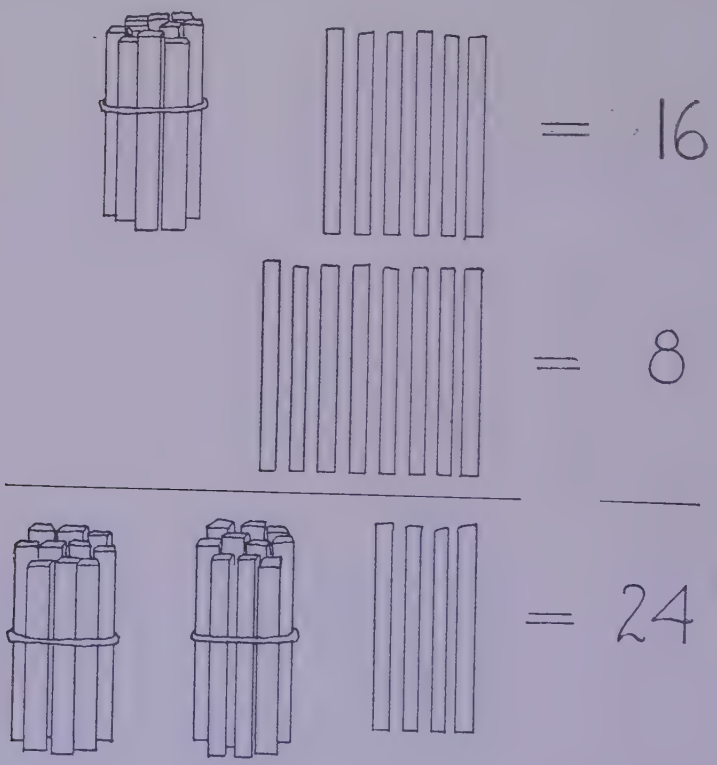


in a straight row, but this orderless group is the natural one. Let the pupils count by two's in this group by placing two fingers on two chicks at a time, until the entire group has been counted. Draw a group showing ten eggs. Have the pupils "pick these up" two at a time and count them. When the number twelve is the subject of drill, they should count the eggs by threes also, then by three in each hand, as the grocer does.

Variety is essential to the maintenance of interest, and pupils should be supplied with material which they can handle. Kindergarten beads, which come in the cubes, spheres and cylinders, are excellent for counting material. Pupils can arrange them in groups, string them on a cord, and use them in various other ways. These beads are inexpensive and any school can afford to supply the pupils with them. Buttons may also be used, but they should at first all be of the same kind.

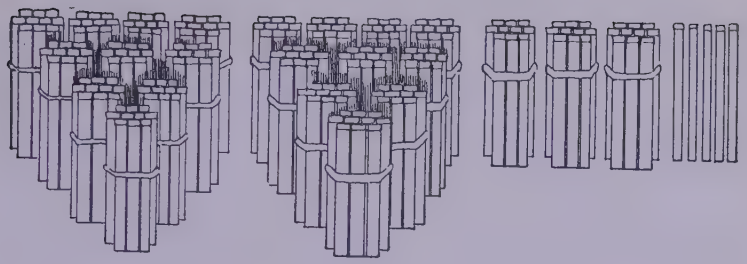
The use of this material, however, will be of no value to the pupils unless they work under the direction of the teacher, who should have each lesson carefully planned so that definite progress may be made. For instance, if the pupils are studying the number six, let them discover how many different groups they can form with their six objects. Supply them with paper oblongs 6 inches long and 2 inches wide, and let them fold and cut the paper into six equal parts. See how many different groups they can make of these parts as well as of the other objects.

To teach the "carrying" process objectively, no method is better than the following:



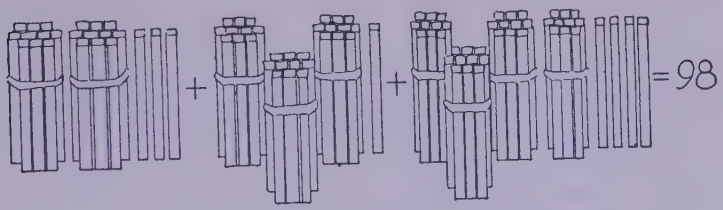
16 = 1 ten and 6 units
8 = 8 units
1 ten and 14 units = 2 tens 4 units = 24

The school should be supplied with bundles of tooth-picks, matches with the heads cut off, weed stems or stiff grasses, or some convenient objects bound in bundles of ten by means of small rubber bands, thus:



2 hundreds 3 tens 5 ones

These bundles are very essential in teaching the process of addition, whether there is any "carrying" as in the first illustration, or simple addition as in the one below:



or 9 tens and 8 ones

23 + 31 + 44 = 98

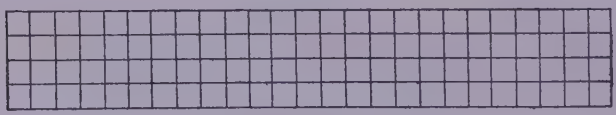
$$\begin{array}{r} 23 \\ 31 \\ \underline{44} \\ 98 \end{array}$$

(b) Drills. The next step should consist in drills on the counting of objects placed in groups or factors making up the number 10, or 9, or 12, or whatever the number to be studied. Again, the picture should be drawn upon the board. Frequent drills in visualizing these groups quickly will not only aid the child in gaining a knowledge of number, but will help in fixing a habit of rapid and accurate visualization. Miss Elizabeth Aiken, in her very suggestive little book on *Mind Training*, illustrates this principle in a number of ways. Too much stress can hardly be placed

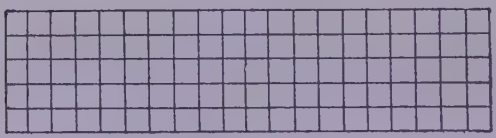
upon this principle of visualization. People generally are too careless in their attention to the images produced by objects of sight, hence are too frequently inaccurate in their accounts of what they see — they have not learned to visualize and count instantaneously.

COUNTING BY 2's

COUNTING BY 3's

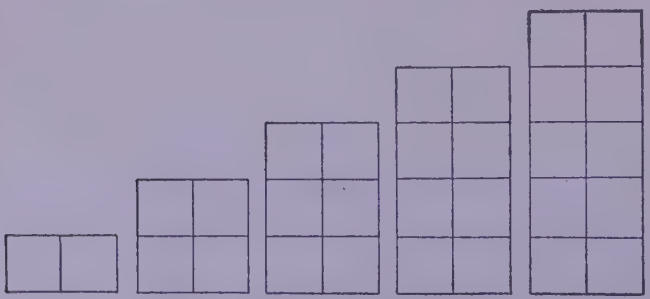


COUNTING BY 4's

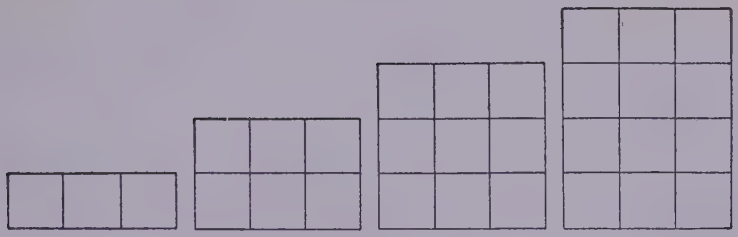


COUNTING BY 5's

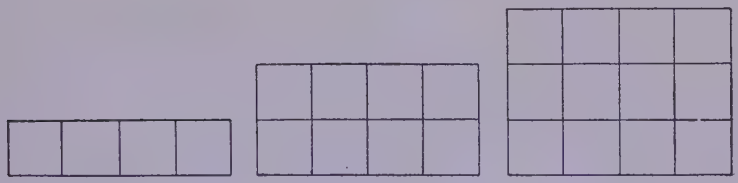
In teaching children to count by 2's, 3's, 4's and 5's, etc., a device similar to the one shown in the illustrations is very helpful. Besides, a great variety of problems may be based upon these squares. The counting should not go beyond 100.



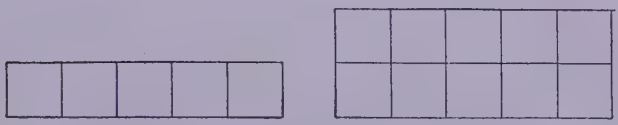
ANOTHER WAY OF COUNTING BY 2's



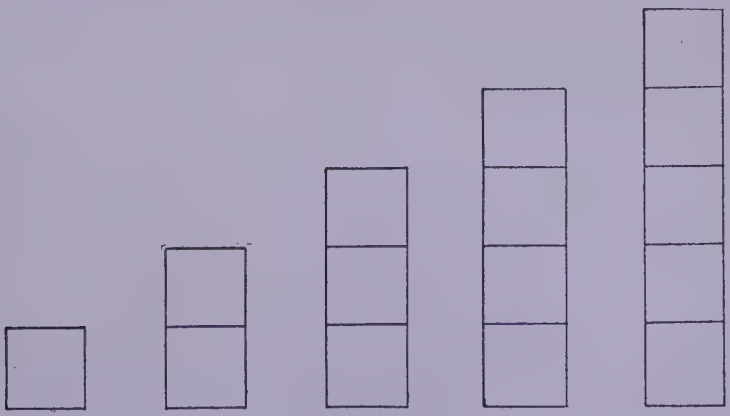
COUNTING BY 3's



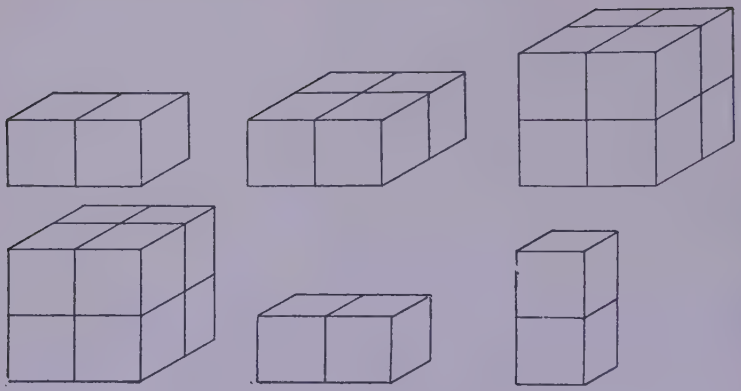
COUNTING BY 4's



COUNTING BY 5's

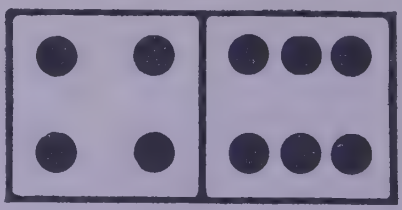


COUNTING TO FIVE



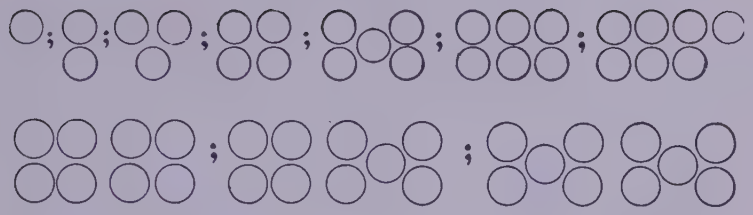
BLOCKS MAY BE USED

(c) Games. Certain games at school may do much to fix visualization. For example, the game of dominoes may be used to good advantage to teach visualization in groups to 6 and 12; also in addition of all possible combinations from 0 and 1, 1 and 1, 1 and 2, etc., to 6 and 6. The child apparently sees only the dots on this domino, but in reality he spells "ten" when he sees them. This process is very essential in fixing the habit of seeing and spelling the word "ten" when he sees 6 and 4 in any position, whether horizontal or vertical. He does not, or should not, say, "six and four are ten," but the *sight* of the two numbers spells "ten" just as t-e-n would mean "ten." Of course, we do not here use the word "spell" in its usual sense — we mean the group of symbols visualized is promptly translated as "ten."



The resourceful teacher will not lack for illustrative material and appropriate blackboard illustrations.

(d) Number Pictures. In connection with this counting work, the results may be represented on the blackboard by means of dots or circles; as,



These results may be represented on cardboard, using colored paper discs. A great deal of rapid work may be done with them. For instance, the teacher shows the card, covers it quickly and asks how many oranges or apples, or whatever the discs represent, were seen. She covers one and asks for the number left. She covers two or three and asks, "How many are left?" "How many were on the card?" "How many are covered?" "We saw five and covered one. Five less one are how many?" The questions may be varied endlessly.

When giving the child the idea of a number, as five, for instance, he should, as far as possible, become acquainted with the number of objects; *five*, the word; and 5, the figure. These three symbols should always be connected.

27. Number Cards. Following the use of the number pictures containing the colored paper discs as stated above, the teacher should introduce the number cards. These she may make by using a heavy durable white cardboard, bearing the figures printed on or stamped on with a rubber stamp or school printer. Such outfits are not expensive and are quite useful in many ways.

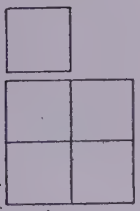
These cards are easily made. Cut white cardboard into pieces 4 by 8 inches. Divide each card into two equal parts by a heavy black line. Procure gummed circles or gummed squares from any kindergarten supply house for the dots. Use the opposite face of the card for figures corresponding to the number of dots.

These cards bear all the simple exercises that should be taught the first school year. These include all the possible additions of two figures, from 1 and 1 to 9 and 9, making 45 in all. Here they are:

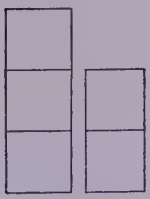
1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9
2	2	2	2	2	2	2	2	
2	3	4	5	6	7	8	9	
3	3	3	3	3	3	3		
3	4	5	6	7	8	9		
4	4	4	4	4	4			
4	5	6	7	8	9			
5	5	5	5	5				
5	6	7	8	9				
6	6	6	6					
6	7	8	9					
7	7	7						
7	8	9						
8	8							
8	9							
9								
9								

(a) Visualization. The pupils are drilled on these visualizations frequently, but very briefly, at each lesson. They learn to read the sums at sight without the process of addition. This is not so difficult as the inexperienced teacher might imagine. The child can just as unerringly learn to think "7" when he sees 3 and 4, as he can learn to say "you" when he sees y-o-u. But psychology teaches us, and experiences enforce the doctrine, that the mind fatigues more quickly when thinking number symbols than when thinking sound symbols, as in spelling and reading. Hence number drills should be brief but frequent.

2 = 1 + 1

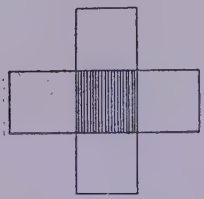


5 = 1 + 4
or 4 + 1



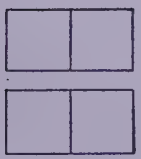
5 = 2 + 3
or 3 + 2

3 = 1 + 2
or 2 + 1

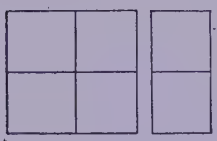


5 = 1 + 4
or 3 + 2

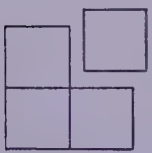
6 = 3 + 3



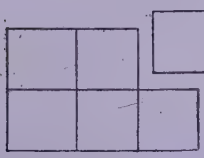
4 = 2 + 2



6 = 4 + 2
or 2 + 4

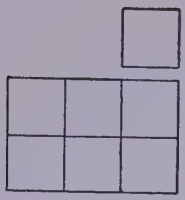


4 = 3 + 1
or 1 + 3

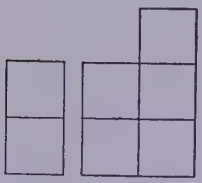


6 = 5 + 1
or 1 + 5

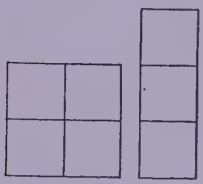
The diagrams on this and the following pages show how primary combinations can be illustrated by blackboard drawings and by having pupils make similar drawings on paper.



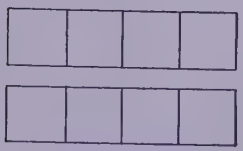
7 = 6 + 1
or 1 + 6



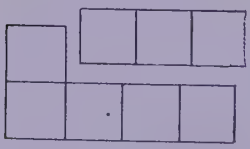
7 = 5 + 2
or 2 + 5



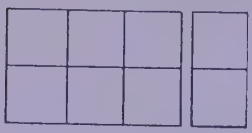
7 = 4 + 3
or 3 + 4



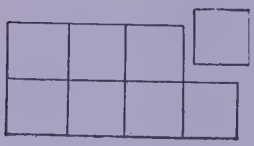
8 = 4 + 4



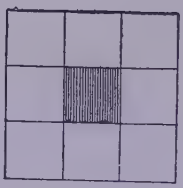
8 = 5 + 3
or 3 + 5



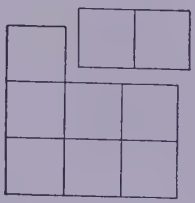
8 = 6 + 2
or 2 + 6



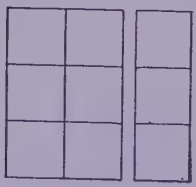
8 = 7 + 1
or 1 + 7



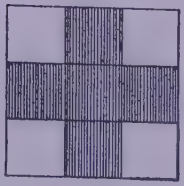
9 = 8 + 1
or 1 + 8



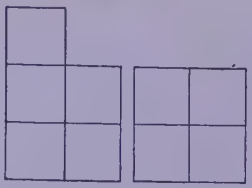
9 = 7 + 2
or 2 + 7



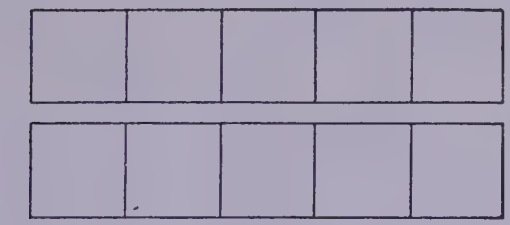
9 = 6 + 3
or 3 + 6



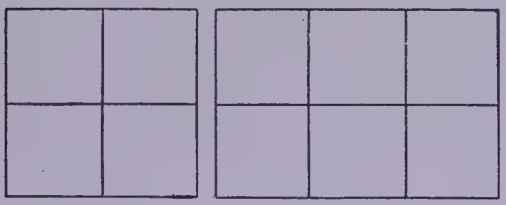
9 = 5 + 4
or 4 + 5



9 = 4 + 5
or 5 + 4

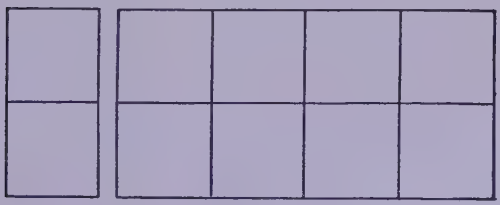


10 = 5 + 5

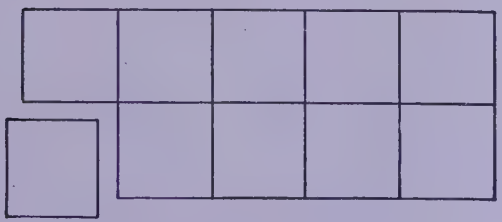


10 = 6 + 4
or 4 + 6

10 = 7 + 3
or 3 + 7



10 = 8 + 2
or 2 + 8



10 = 9 + 1
or 1 + 9

(b) Cumbersome Methods. In some training schools, young teachers are taught to present these combinations in addition thus:
1+1, 1+2, 1+3, 1+4, 1+5, 1+6, 1+7, 1+8, 1+9, etc. These are read, "One and one," "one and two," etc., and the results are announced, "one and one are two, one and two are three, one and three are four." There are several objections to this method:

(1) This is not the natural position in which our "sums" in practical life are found. Numbers for addition are placed in a vertical column.

(2) It encourages the continuance of the very primary method of repeating, in each addition, the numbers to be added and the process as well. This is not necessary beyond the earlier illustrative steps in addition. It is a habit that is difficult to break up.

(3) The actual counting process involved in saying "two and three are five," is unnecessary and a hindrance to complete confidence. The child must be taught to *think* 5 when he sees 2 and 3 in a column. If any process other than addition is intended, such process should be indicated.

(4) If such a method of teaching the 45 sums is pursued it should be reversed and the problems should read: 1+1=2, 2+1=3, 3+1=4, 4+1=5, 5+1=6, 6+1=7, 7+1=8, 8+1=9, 9+1=10. The larger number should be thought first, until the combinations are known at sight. Later in the grades, perhaps in the second year, the pupil must be so sure of himself that he will not hesitate to announce results whether the problems read "3 and 6 are 9," or "6 and 3 are 9." By this time he *knows* it makes no difference whether he counts a row of 3 boys and 6 girls by commencing with the boys or with the girls, or whether counting is done from the right or from the left, or whether by 1's, 2's or 3's — he finds the result is always the same.

(c) Multiplication Tables. *Learning the Twos.* Here is an illustration designed by a resourceful teacher to show

her pupils that multiplication is an easy way to *add* numbers. Pupils are to find the sum of each column, and the number in the "ring" at the top indicates the number of 2's there are in the column. Similar tables are constructed for the 3's, 4's, 5's, 6's, 7's, 8's and 9's, as they are needed. In the first grade this device should not be used farther than six 2's.

1	2	3	4	5	6	7	8	9	10
2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2
		2	2	2	2	2	2	2	2
			2	2	2	2	2	2	2
				2	2	2	2	2	2
					2	2	2	2	2
						2	2	2	2
							2	2	2
								2	2
									2

(d) Extent of Use. *The Number Cards* should include all the other exercises to teach the fundamental processes as far as they should be carried the first school year. In subtraction, the work should go just as far as the addition, with 18 less 9 as the maximum. In multiplication and division, however, it will usually be found quite satisfactory to set 12 as the maximum although no child should be penalized in any way if he should discover before he enters upon the second school year that three 5's are 15, or that 18 apples are just enough to allow each of six boys three apples. For example these problems in multiplication should appear upon the set of Number Cards:

1	2	3	4	5	6
2	2	2	2	2	2
2	4	6	8	10	12
1	2	3	4		
3	3	3	3		
3	6	9	12		
1	2	3			
4	4	4			
4	8	12			
1	2				
5	5				
5	10				
1	2				
6	6				
6	12				

28. Duplications. By the use of the cards it will be discovered that several of these problems are duplicates. Hence the drills should be confined chiefly to 2×2, 2×3, 2×4, 2×5, 2×6, 3×3, 3×4, 5×2, only 8 problems. These should be read backward as well as forward: "Two times three, two times four, two times six, three times four," etc., and then "three times two, four times two, five times two, six times two," etc. There are but eight possible problems in multiplication up to a product of 12, when we eliminate the duplicates and those involving 1 as a multiplier. Even a child in a kindergarten knows that 3 is 3.

The importance of this observation rests with the fact that the tedious process of memorizing *all* the tables is as unnecessary as it is unpedagogical. Another observation is, that emphasis in instruction and drill should be given the more difficult steps and processes. If a child learns to recognize the eight products and their relations to the factors producing them, a long stride has been made toward a complete mastery of the multiplication "table" later.

29. Division. The process of division of the composite numbers up to and including 12 should be taught in connection with the multiplication. Here, then, are the problems on the division cards:

2)2	2)4	2)6	2)8	2)10	2)12
1	2	3	4	5	6
3)3	3)6	3)9	3)12		
1	2	3	4		
4)4	4)8	4)12			
1	2	3			
5)5	5)10				
1	2				
6)6	6)12				
1	2				

These are read "two into 2, 1 time; two into 4, 2 times; two into 6, 3 times," etc. As in the case of the Multiplication Cards, the teacher should have a set containing only the problems and not the results.

30. Solution of Problems. There are no strong reasons against teaching the use of the signs +, −, × and ÷ in this grade but it is not at all necessary to do so. It is seldom safe to teach a beginner *two* ways of doing a thing until he has become thoroughly habituated to *one*. Even in the solution of problems of a concrete character, it is very doubtful whether the child in the primary grades should be taught more than the one solution which seems best to the teacher or the maker of the course of study. Walsh and Suzzallo say in the preface to *Book One* of their

Walsh-Suzzallo Arithmetics, something important bearing upon this point:

> The use of more than one way of working an example [solving the problem] has been carefully avoided. We should be content with one concrete method of computation, particularly in the primary grades. To attempt to develop two different habits of response to the same situation leads to confusion and waste. Short methods of operation (methods of business) are given only in the higher grades.

31. Fractions. The Number Cards may also contain simple exercises in fractions — the visualization of fractional parts, and the reading of fractions, but no computations in fractions. The child at this age knows the half and perhaps the fourth, when he sees it in the form of an object, such as an apple or a pie or a cake, or stick of candy, although, pedagogically speaking, the stick of candy is least appropriate because candy in this form is not so frequently seen as formerly. The teacher uses her cardboard again and cuts from colored paper a circle, a half circle, a quarter circle, a third of a circle, a sixth of a circle, and pastes these upon the cards with their equivalents in fractional forms, thus: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$, $\frac{5}{6}$. These exercises should consist only in visualizing fractions, not in computing them.

32. Reading and Writing Numbers. The fact that we limit the operations of numbers to 12 in the first grade has no direct bearing upon the reading and writing of numbers. Children are fond of counting "big" numbers, and in this grade may be encouraged to count to 100. The fact is, when one has learned to count to 100 one has learned nearly all there is to know about counting. To count to 200, we count 100 twice. In writing numbers the child often needs to write numbers representing his own street address, the number of the page on which the lesson is found, etc. In a similar way, he needs to know how to read such numbers. It is not necessary that the child be able to image the relation of numbers larger than twelve in order to be able to *read* them or *write* them. If we were to wait until we

could really experience a thousand or a million before we were permitted to use numbers of that size, not many of us would ever use those numbers, because we would never have the experience.

(a) Calculations to Twelve. *Perhaps some teachers* may be curious to know why calculations and operations in the four fundamental operations in the first grade should go to 12, rather than stop at 10. The answer is simply this, we use 12 very often and quite early in our practical experiences. There are 12 inches in a foot; and children of the first grade need to measure with the ruler. There are 12 things in a dozen; and children need to know how to count a dozen and at the same time divide it, combine its factors, etc. There are 12 hours on the clock face; and the child needs to know how to tell the time of day. There are 12 months in a year; and children of the first grade like to know how to use a calendar, name and number the months of the year, and group the months into Autumn, Winter, Spring, and Summer.

(b) Addition and Subtraction. As to addition and subtraction it is not important that children be taught to carry these processes farther than 12 the first year. However, children do very easily learn much more addition than that, and in some schools the entire 45 combinations are taught the first year. We would advise, however, that such an achievement by the close of the second year would be sufficient. Of course, the 45 combinations do not include 10 and 10, nor any of the 10's, but these are so easy to learn that the teacher will not need to require much drill thereon. As to multiplication and division in the first grade, it may be stated that the balance of the course in number for this grade could not be seriously affected by the omission of these topics from this grade. The multiplications of this grade should, at any rate, be taught first as additions of a given number of groups of the same size — the addition of five 2's, or three 4's, or six 2's, etc. The transition from this operation of addition of a fixed number

of numbers, all of the same size, to the corresponding process of multiplication, is quite easy for the reason that the transition is one made through the *form* and *language* employed to express a shorter process of addition.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
2	4	6	8	10	12	14	16	
3	6	9	12	15	18	21		
4	8	12	16	20	24			
5	10	15	20	25				
6	12	18	24					
7	14	21						
8	16							
9								

(c) Multiplication. This multiplication table is for the second grade, although many children of the first grade will learn to "build" it without much instruction beyond the regular assignment for the first grade—to products not exceeding 12. The products to be learned in the first grade are indicated by black-faced type. There are only 12 of them, and 6 of these are duplicates, leaving but 6 products to learn in this grade.

33. Fractions. We always approach this subject with fear and trembling in the first grade. We think it would be well to leave a few topics and processes in arithmetic to be introduced into later grades. However, in the first grade, the teacher should take an inventory of the knowledge

already possessed by her pupils. She will doubtless find that all of them know the half when presented objectively. Some of them will know the fourth or quarter as one-half of a half. To them a *half* is a whole thing of one kind and the whole of a thing is a whole thing of another kind, just as it requires 12 things of a kind to make 1 thing of another kind, or name, called a dozen. All the work in fractions in this grade should be presented by means of objects and pictures. Abstract calculations in fractions, even $\frac{1}{2}+\frac{1}{2}$, should be studiously avoided.

Even this objective method of presentation is frequently carried too far. Teachers are sometimes led to think they are teaching fractions by means of blocks so shaped as to show to the sight, or to the touch, relationship by multiples — one block is twice as large as another, or one is one-fourth as large as another. This is a valuable method of training the sense of sight and the sense of touch, but the child is not gaining much knowledge of fractions. What he *is* getting, aside from the training of certain senses, is a knowledge of *ratio*. He learns that one whole thing is twice as large as another whole thing, or that one line is four times as long as another line. There is no idea of fraction in this conception. *A fraction* is one or more of the equal measured portions of a whole thing. Illustrate this thought by means of such blackboard drawings as these:

34. Explanations. In illustration No. 1, the idea is to have the child visualize the *whole thing*—a solid—and to see how it is divided, first into two equal pieces (he measures them), and then how each of these equal parts is divided into two equal pieces—the child will say, "the half of one-half." After visualizing these solids and the *equal parts* into which each has been divided, the child is taught how

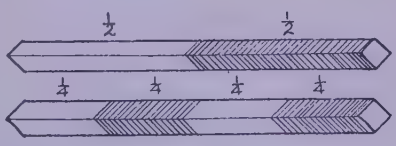


Figure 1

ONE-HALF ONE-QUARTER

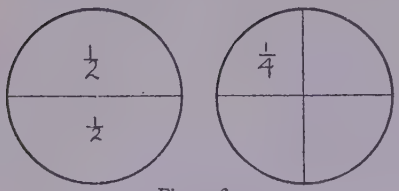


Figure 2
EQUAL PARTS

to express orally the names given to those parts. Next he is taught the symbol to represent the part one-half of one-fourth. It is useless and unnecessary to teach him numerator, denominator, and what each one represents. He does not need to know this, even if he could be taught it.

Figure No. 2 presents the same idea and suggests the same method, the difference being that in the latter illustration only a surface is shown. This might be made more vivid by calling it a pie, when it becomes a solid, although not a geometric one. Figure 3 illustrates the same method in another way and in Figure 4, the third is introduced.

Figure 3
EQUAL PARTS

Figures 5, 6 and 7 are self-explanatory. These illustrations should not be used for any calculations or number

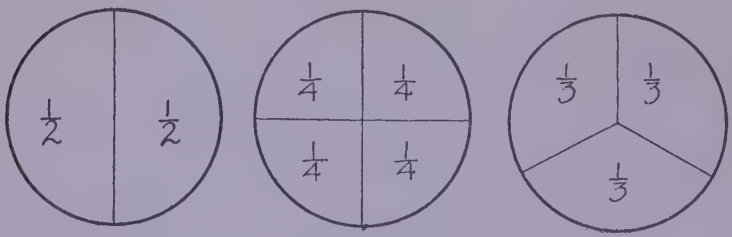


Figure 4
FRACTIONAL PARTS

processes in this grade, but merely to strengthen visualization and to impress the fundamental concept of a fraction — as a measured number of the equal parts of *one* or the whole of a thing. In the second, third and fourth grades, Figures 5, 6 and 7 may be used again and again to illus-

trate various relationships. For example, in Figure 5 we have two halves, each equalling the other, and either the shaded one-half or the light one-half is equal to $\frac{2}{4}$, or together they are equal to $\frac{3}{3}$, or $\frac{4}{4}$, or $\frac{5}{5}$. In Figure 7, it is seen that each fourth is divided into halves; that $\frac{1}{4}=\frac{2}{8}$, or $\frac{3}{12}$, or $\frac{4}{16}$, or $\frac{5}{20}$. All this is shown objectively and the

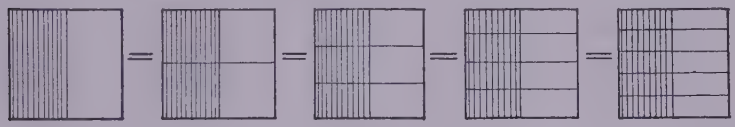


Figure 5
DIVIDED HALVES

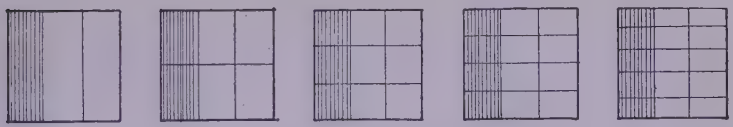


Figure 6
PARTS OF THIRDS

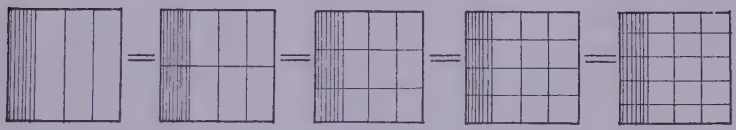


Figure 7
DIVIDED FOURTHS

child soon learns the real meaning of "reducing a fraction to its lowest terms," an expression almost certain to be meaningless to the average child, even in the fourth or fifth grade, without pictorial or graphic illustration to produce visualization of the fact as a concrete thing. (Figure 7.)

35. The Use of Measuring Units. Arithmetic is of but little value to any individual unless it teaches him how to solve his problems. The practical applications of arithmetic are of two kinds — the application of the fundamental operations to any problem growing out of one's varied experiences, and the application of various measuring units to such concrete experiences. Arithmetic in its applications is very largely a science of measurement as well as a

science of computing numbers. Even in the first grade the child should be taught how to measure. He may be taught the use of the foot-rule and even of the yardstick. He may be taught, at least, how some things are weighed, and how some others are measured in vessels, and others are measured with a ruler or yardstick. He may be taught how money is measured, for the values of the various coins represent measures.

(a) The School Store. To aid in the teaching of this interesting subject, the school should have a school store with real articles in it and school money as the medium of exchange. Children of six may learn to go to the store to purchase bread, cakes, sugar, and various notions. They enjoy playing store. They like not only to go to this store and make the purchases, but they enjoy still more being store-keeper. There is more responsibility in this situation, and children enjoy responsibility. Why? Because this is an attribute of grown-ups and children naturally enjoy the thought that they are almost grown-up already, and should be learning how to do the things that grown-ups do. The store for the first grade, of course, should be very simple and may be wholly make-believe, but in the upper grades, wherever this is possible, there should be a room set apart for this purpose, and pupils should be sent to it to make real problems and to solve them.

In the first grade, children should be taught to make change in purchases up to 10 cents. The child should be started right by being taught to count from the amount of the purchase to the amount of money used in the transaction, thus: A child buys at the school a pencil costing three cents. In how many and what ways could he pay the amount? If he has pennies, how many will it require? If he has a nickel, how much change should he receive from the store? If he has only a dime, in what form may he receive his change, and how much? Frequent concrete exercises will be needed, but such exercises are looked forward to with delight by the child. Such concrete expe-

riences may, in time, be followed by abstract problems such as the following:

4
3
1
5
2

8
2
3
1
4
6
7
5
9

The figures in the column indicate the amount of the purchase; and the coin at the top indicates the amount of money tendered in payment. The abstract problem is to determine at sight the amount of "change" the purchaser should receive, and the probable coins in which the amounts would be paid. Even in the first grade, children will want to take a quarter to the "store" and see if they can bring back the right change. A game may be made of it, and the child who returns oftenest with the correct change is the winner in the game.

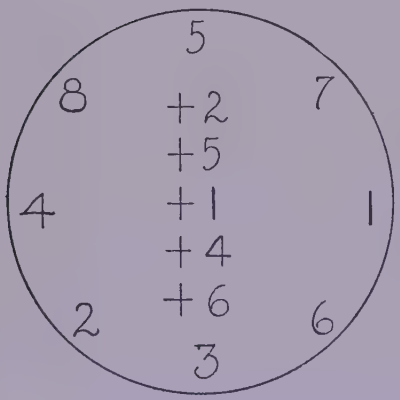
36. Use of Games in Teaching Number. Even in the first grade, children will readily learn to "match" dominoes and to call out quickly the groups, as 2-6, 3-4, or even the total number of dots. This may be played as a game, with simple rules of contest.

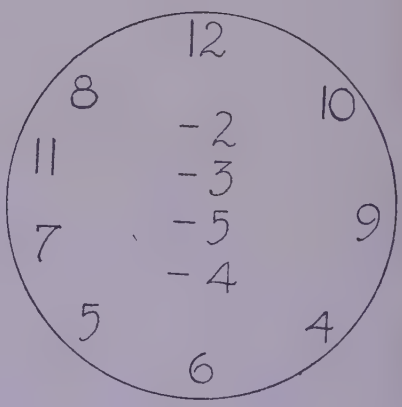
(a) Bean Bag. Several very simple games of Bean Bag may be played and the children not only thoroughly enjoy the game, but, at the same time, they are gaining experience in thinking number. (See Vol. I, page 426.)

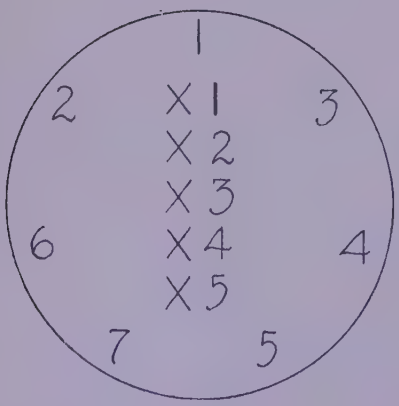
(b) Tag. This game may be played indoors as well as out-of-doors, and is always acceptable to small children.

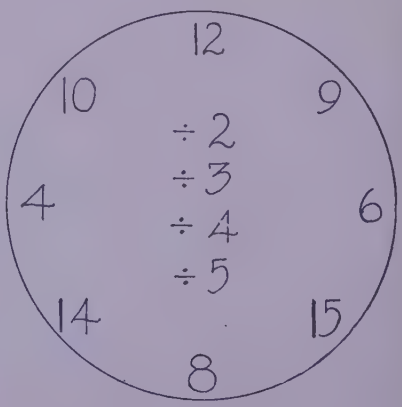
(c) Odd and Even. This is a simple number game and aids in making children alert as to the nature of odd and even numbers.

(d) Around the Circle. Let the teacher use the circle for teaching combinations and processes as far as 12 in this grade, thus:









37. The Combinations. Too much stress can hardly be placed upon the use of drills, brief, but frequent. The 45 combinations of two figures each, illustrated on a preceding page, may be expressed in the form of a table for rapid visualization, thus:

	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2		4	5	6	7	8	9	10	11
3			6	7	8	9	10	11	12
4				8	9	10	11	12	13
5					10	11	12	13	14
6						12	13	14	15
7							14	15	16
8								16	17
9									18

So much ultimately depends upon unerring accuracy in thinking number relations that even in the primary grades the teacher is justified in training her pupils to see in numbers their component parts — an analytical process. The child is first taught that 6 and 6 are 12, or 9 and 3 are 12, or 8 and 4 are 12, or 10 and 2 are 12, etc. This is synthetic, and may very profitably be followed with very simple analytic processes such as $4=2$ and what? $5=1$ and what? $6=4$ and what? $8=5$ and what?

This is later followed with analytical exercises such as these:

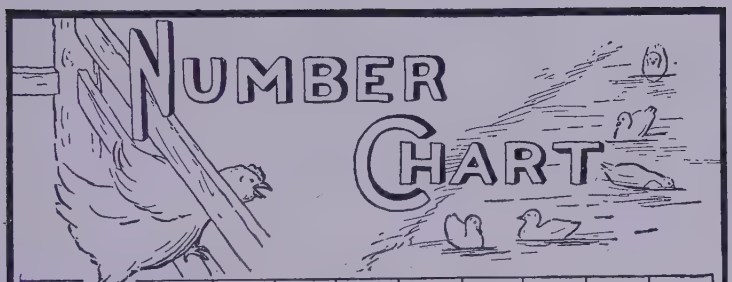
2 = 1 + 1
4 = 2 + 2; or 3 + 1
6 = 3 + 3; or 5 + 1; or 4 + 2
3 = 2 + 1
5 = 3 + 2; or 4 + 1
8 = 5 + 3; or 7 + 1; or 6 + 2; or 4 + 4
7 = 4 + 3; or 6 + 1; or 2 + 5
10 = 5 + 5; or 6 + 4; or 8 + 2; or 9 + 1; or 7 + 3
9 = 3 + 6; or 5 + 4; or 7 + 2; or 8 + 1
12 = 6 + 6; or 7 + 5; or 8 + 4; or 9 + 3; or 10 + 2; or 1 + 11
11 = 5 + 6; or 7 + 4; or 8 + 3; or 9 + 2; or 1 + 10

By the use of the Number Cards these drills may be given at frequent intervals without inconvenience or loss of time. For example, the same card may be used for a number of exercises. Suppose the card bears this problem, 4 + 5 = 9. This should be read in four ways: 4 plus 5 equals 9; 5 plus 4 equals 9; 9 less 5 equals 4; 9 less 4 equals 5. This may be done even when the card shows the figures in a vertical column, which is the natural order and should generally be used.

(a) Roman Numerals. Roman numerals should be taught in the first grade to 12, to cover the requirement in reading the clock face. Children may be taught to tell the time by the clock faces on page 304. The hours should be read thus: "Four o'clock; two thirty; six fifteen; one forty-five." In a short time most children will learn to count the 60 minutes by 5's and soon understand why we say "Three fifteen."

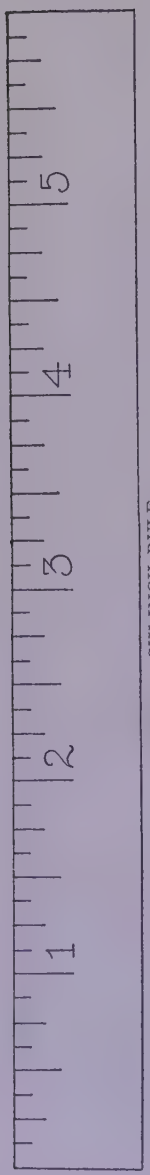
38. The Principle of Correlation. Usually any subject is made more interesting if some relationships are discovered between it and some other branch of study. Then, too, the subject seems to the learner more worth while if he can see how it helps in learning or retaining something else. This relationship calls for correlation in teaching—teaching two things at the same time because they support each other.

There is less correlation of number with language, or any other elementary subject, than there is of language and



ONES	TENS	TWENTIES	THIRTIES	FORTIES	FIFTIES	SIXTIES	SEVENTIES	EIGHTIES	NINETIES	HUNDREDS
ZERO	10	20	30	40	50	60	70	80	90	100
1	11	21	31	41	51	61	71	81	91	
2	12	22	32	42	52	62	72	82	92	
3	13									
4	14									
5	15									
6	16									
7	17									
8	18									
9	19									

An attractive chart may be drawn on the blackboard and used in drill exercises to give the pupils speed and accuracy in writing numbers.



SIX-INCH RULE.

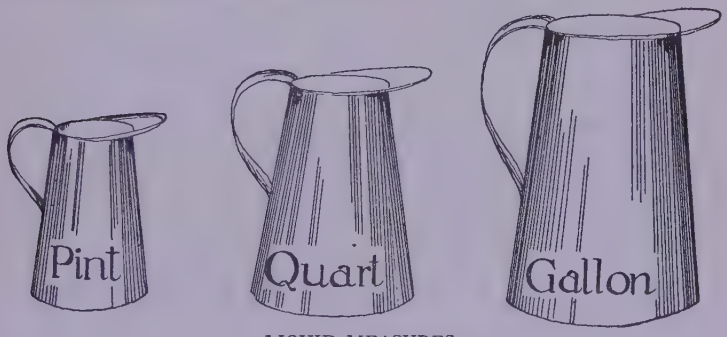
nature study, or language and history. Yet this correlation exists and should be utilized.

For example, the pupil must be taught the correct use of *larger* and *largest* as in "John is the larger of the two boys," and "John is the largest of the three boys." While these terms are not numeral they are virtually so in such usage. The same is true of *smaller*, *smallest*; *heavier*, *heaviest*; *lighter*, *lightest*; *older*, *oldest*, etc. The child's language in expressing numbers and number operations should be watched closely and correct habits formed.

(a) Drawing. In drawing, the child needs to employ his concepts of number, size, shape, ratio. Many lessons in drawing may be given with the specific end in view to fix the ideas of square, triangle, straight line, circle. In later grades, these lessons would include angles, solids, terms used in solving relationships of surfaces and solids, such as diagonal, perimeter, solid contents, superficial contents, volume, altitude, base, perpendicular, right angle, acute angle, obtuse angle, and the names and characteristics of the various geometrical forms, such as cone, frustum, pyramid, etc. Much of the inaccuracy and even total lack of knowledge of these terms in grades far above the primary, is due to a lack of understanding of the meanings of the terms employed in a given problem. The "learning" (memorizing) of definitions will not remove this short-coming—children must be taught to employ the terms in language of their own. The primary teacher should start this valuable language training in the use of terms concerning number, form, ratio and relation.

(b) The Ruler. The child in the first grade should be taught the uses of the ruler, and

how to make simple measurements with it up to 12 inches, then to call that a "foot." He will soon be measuring lines and objects longer than one foot and will be saying it is 2 feet long, or 3 feet long, not 24 inches and 36 inches. Every schoolroom blackboard should have measured and painted in white near the top edge of the board, a line a rod long; and this should be divided into yards; and the first yard should be divided into feet; and the first foot into inches. In this way the children will learn early to visualize these four units of measure. They will not need much explanation by the teacher. It is quite surprising to find a large percentage of people, who have passed through the complete elementary school course, unable to visualize a foot or a yard or a rod. A six-inch rule like that shown in the cut can easily be made of cardboard and every pupil should have one.



LIQUID MEASURES

39. Lessons to Cultivate Ability to Judge Measurements.

(a) MATERIAL. Pint, quart, and gallon measures, with pails of various sizes.

(b) METHOD. The teacher begins by asking the children how many of them have ever gone to the store to buy vinegar or molasses or oil, in response to which, many answer that they have done so. Then the teacher may say:

"How much did you ask for?"

Perhaps the children may answer "A jugful," or "ten cents' worth," or "a pint," "quart," etc.

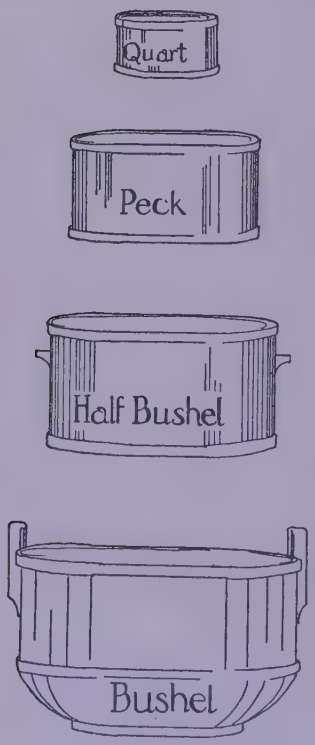
The teacher may continue the conversation somewhat as follows:

"What did the storekeeper do then?" (Various answers.)

"Well, how does he know how much to put in? If you ask for a pint, how does he know when he has given you a pint?"

"He measures it."

"I have a measure here that the storekeeper uses in order to give us just the quantity we want. Does any one know how much it holds? Well, it holds one pint. Now, this morning we are going to buy and sell vinegar and molasses. Can any one think of anything else we measure by the pint, so that we can sell that too?" (Oil, milk, syrup, etc.) "Very well, we shall buy and sell all of these. Frank, I should like to get a pint of oil from you this morning. Here is my can to put it in." (Frank measures out a pint of water.) "But I do not like that kind of a pint. The measure was not full and then you spilled some." (The children thus learn to be careful.) "Mary, sell Tom two pints. Sue, sell Henry half a pint. Sell Will three pints, Ruth. Now, here is a larger measure that the storekeeper often uses (showing a quart cup). Does any one know how much this holds?" (Possibly some one knows the name quart. If not, it is told.)



DRY MEASURES

"Which is the larger, the quart measure or the pint measure?"

"The quart measure."

Photograph from Detroit Normal Training School

NUMBER LESSON

"Which one will hold the more, then?"

"The quart measure."

"How shall we find out how many pint measures full it will take to fill the quart measure, or any of these larger vessels?"

The children suggest that they *try* it — fill the pint measure full and pour the contents into the quart measure, or jar, or bucket, or peck measure. It is best to use dry sand for all such measurements. The children will take great interest in measuring. They soon discover that measuring is another way of *counting*. The measuring game may be made very interesting and even exciting.

Here are some of the measures with which the school should be provided, at least one complete set in each building.

Each schoolroom should be provided with the common methods of measuring and weighing. The school store should have a complete set of weights and measures and a large chart setting forth the tables and their uses. Teachers can make these charts. However, an excellent chart may be obtained of the Department of Commerce and Labor, Bureau of Weights and Measures, Washington, D. C.

40. Books for Teachers. There are many books on general methods that contain much of value to the primary teachers on the subject of the teaching of arithmetic.

General Method. Frank M. McMurry. The MacMillan Co., New York; Chicago.

The Art of Teaching. E. E. White. American Book Co., Cincinnati; New York; Chicago.

Rational Elementary Arithmetic. Belfield and Brooks. Scott, Foresman & Co., Chicago.

The Teaching of Primary Arithmetic. Henry Suzzallo. Houghton Mifflin & Co., Boston.

The Teaching of Arithmetic. David Eugene Smith. Ginn & Company, Boston; Chicago.

How to Teach the Fundamental Subjects. Kendall and Mirick. Houghton Mifflin Company. Chapter III. *Mathematics.*

Werner Arithmetics and The Teacher's Handbook accompanying the same. American Book Company, Cincinnati; New York; Chicago.

A Primary Arithmetic for Teachers. William W. Spear. Ginn & Company, Boston; Chicago.

How to Teach Arithmetic. Brown and Coffman. Row, Peterson & Co., Chicago; New York.

The Psychology of Number. Dewey and McClellan. D. Appleton & Co., New York.

A Text Book on the Teaching of Arithmetic. A. W. Stamper. American Book Co., Cincinnati; New York; Chicago.

A Teachers' Manual of Arithmetic. Edw. M. Mills. The *Ohio Teacher*, Columbus, Ohio.

Education by Play and Games. George Ellsworth Johnson. Ginn & Co., Boston; Chicago.

The Teaching of Elementary Mathematics. David Eugene Smith. Silver Burdette & Co. Boston; Chicago.

Mathematics in the Elementary Schools of the United States. Bulletin No. 13, 1911. Bureau of Education, Washington, D. C.

SECOND YEAR

41. Review First Grade Directions. Teachers of the second grade are advised to read carefully the Introduction to the course in arithmetic beginning on page 177, and to follow this reading by a careful study of the allotment of work and the methods for the first grade. It is not at all desirable to undertake a definite allotment for any grade. A minimum standard may be fixed, but even that should not be allowed to stand as a fixed barrier against a child's promotion if his work in other subjects shows sufficient strength to do the work of the next grade. A course in arithmetic must be determined more by sequence and utility than by anything else. There is such a wide variation in the number sense among children that it is the height of folly and a pedagogical blunder of a serious nature to hang a child's fate on his showing in arithmetic alone.

42. Text-Book. No book should be used in this grade unless the school be a multigraded school where the teacher would have so many classes that she could not give the number lessons sufficient personal attention. In such a

case a book may be used as a partial substitute for a teacher. If the teacher has been properly trained she will be sufficiently resourceful to prepare exercises, drills, and lessons better suited to the child's needs than those in a text-book. The text-book must be general, while the pupils' need is usually special. A good text-book in this grade, however, is better than a poor teacher.

43. Illustrated Lesson. Let 34 multiplied by 24 be an illustrative problem. This lesson should be preceded by a rapid test in reading such numbers as 1276, 62, 372, 580, 52 tens, 59 units, 4271, giving the units, tens, hundreds and thousands.

The teacher then says, "We have often multiplied a number by one figure, but never by two. Now we are going to learn how to multiply a number by another number with two figures. Here is our problem: The teacher writes $\begin{matrix} 34 \\ 24 \end{matrix}$ and reads, "Thirty-four multiplied by twenty-four. In 34, how many tens and how many units, Mary?"

"There are three tens and four units."

"In 24, how many tens and how many units, Harry?"

"There are two tens and four units."

"The first thing we must do is to multiply thirty-four by the units in twenty-four, which are how many units, Bessie?"

"Four units."

"Rachel, multiply thirty-four by four units for us."

"Four times four are sixteen, or one ten and six units. Four times three are twelve, and one ten more makes it thirteen. Thirty-four multiplied by four equals one hundred thirty-six."

The teacher writes 136 in its place.

"We have now multiplied thirty-four by four units. What is there left for us to multiply by if we are to multiply by twenty-four?"

"Two tens."

"Two tens are the same as how many units?"

"Twenty units."

"Very well. Let us call the two tens twenty units for the present. Multiply thirty-four by twenty units for me. Twenty times four units equals how much?"

"Eighty units."

"Eighty units are the same as how many tens?"

"Eight."

"Where shall we write eight tens? Under the units' column or tens' column?

"In the tens' column."

It is written.

"Twenty times three tens equals how much?

"Sixty tens."

"Who can write sixty tens for me?"

Some one writes 60.

"Class, is that sixty tens?"

600 is written.

"Is that sixty tens?"

"Yes."

"What is another name for it?"

"Six hundred."

"Since it is the same as six hundred, where must we put the six? In units', tens' or hundreds' column?"

"Hundreds."

It is written.

"We know now what thirty-four multiplied by four is, and what thirty-four multiplied by twenty is. Can any one tell us what we must do to find out what thirty-four multiplied by twenty and four together equals?"

Cautions. (1) Do not allow any guessing. Unless some child has been quick enough to see, simply tell the class that the product must be added. Work very slowly with these problems and work out a good many with the class before giving the pupils any to do alone. In a short time they will not need to think of the tens as so many units, but can multiply by tens directly and put the product in the right place.

(2) Failure to secure accurate results is often due to

advancing the work too rapidly. The pupils should be given a large number of problems of about the same degree of difficulty before any more difficult are attempted, and the steps from one class of problems to the next should be very slight. The best results are secured when the pupils thoroughly master the form and method before they are called upon to perform multiplications that require them to give most of their attention to the process.

(3) A point often overlooked by teachers is that combinations of odd numbers are more difficult than those of even numbers. In preparing tables for drills this should be kept constantly in mind, and those combinations should be presented upon which the pupils need the most practice. Watchfulness on the part of the teacher will enable her to determine what these are. There is great danger of falling into a rut and using the same combinations over and over. To children, an old truth is always new when presented in a new light. Frequently change your drill exercises, even though they include the same numbers and combinations that you have been using.

(4) Bear in mind that the skill attained in this work depends to a large degree on how well the multiplication tables are known. If children stumble over multiplication facts, and are not especially troubled with mastering the process, discontinue the work on the process and drill on the multiplication tables.

44. Reviews and Drills. During the second year the pupils should review most thoroughly the outline of work covered during the first year. The teacher should not hesitate to devote much time to drill. One of the most severe criticisms on the work done in arithmetic in the public schools touches the matter of inaccuracy and a lack of thoroughness. A man's arithmetic is not worth much to him unless it enables him to get the right answer every time. To this end, frequent drills of brief duration are essential in order that all combinations and operations may instantly be visualized upon presentation.

45. The Forty-Five Combinations. The combinations in addition up to 9 and 9 should be mastered thoroughly in the second grade. The multiplication "table" should be completed as far as 50. Some teachers think this is a very limited program but there are hundreds of abstract problems alone that may be included within this range. To the abstract problems may be added a limitless number of concrete problems. It would be better to fall short of 50 in the second grade than to try to exceed it. We do not believe it best to have the multiplication table taught as such but to have the various products learned as the result of counting and grouping objects, or pictures. The Roman numerals should be taught to L. In the first grade the first twelve numbers were taught in Roman numerals to enable the child to determine the time by the clock. In the second grade the relative values of the letters I, V, X, and L may be taught.

46. Reading and Writing Numbers. Pupils of this grade may well be taught to read and write numbers to and including thousands, or numbers of four figures. The teacher will find that the process of learning to read hundreds is the most difficult. As soon as the child has learned how to write hundreds, or numbers containing three figures, it is an easy step to the writing of thousands. In order to aid the teacher in this development we suggest that she use a number chart like the one here given which will lead the child to the conception of hundreds almost unconsciously. He learns to read and write tens, twenties, forties, seventies, nineties, hundreds, and thousands. Instead of writing a column for 200, a column for 300, etc. to 900 and then 1,000 he is led directly into writing thousands following hundreds. The teacher will find that the child usually enjoys *making* his tables, when if he were required to *commit* the tables somebody else made, he would find it irksome.

Another device for the teaching of reading and writing numbers may be described as follows: Let the teacher draw

upon the blackboard what she calls a money drawer. This corresponds to the money drawer in a cash register. In one compartment she places all the pennies and nickels, or every coin less than ten cents. In the next compartment she places all the dimes, quarters, and fifty cent pieces, or all the coins worth ten cents and less than one hundred cents. In the next compartment she places the silver dollars, and all the paper money she collects in her store. The children now have not a real cash register drawer, but one which will prove very convenient in learning to read and write numbers to 1,000, and still more convenient when it comes to teaching the processes of so-called borrowing and carrying. If the teacher is supplied with school money she may have the pupils learn concretely how to convert the coins in the first box or compartment into coins for the second or how to exchange pennies and nickels for dimes. In a like manner they learn how to exchange their dimes, quarters and half dollars for dollars, and what to do with the amount left over after obtaining as many silver dollars or dollar bills as possible for the smaller coins on hand. They are now learning several things at the same time: they are learning how to make change and they are learning that ten cents equal 1 dime, 10 dimes equal 1 dollar, or 100 cents; 10 dollars equal 1,000 cents, etc. The remainder of the work in teaching United States Money is merely a matter of punctuation.

47. Carrying in Addition. By the use of the device described above, the teacher can easily show the pupil that all pennies and nickels may be converted into dimes, and the odd cents left over in the compartment for cents and nickels. In a like manner in adding a column of seven and five they can be shown that the 12 is composed of 1 dime and 2 cents. In a like manner if in the second column the figures to be added are 8 and 5, the sum would be 13 dimes, and 10 of these dimes can be exchanged for $1.00 and this dollar should be placed in the till or compartment designed for dollars. Similarly the change from hundreds to

thousands may be shown. In fact, an ordinary problem such as the following may be written upon the blackboard and the process of carrying be clearly illustrated by means of the money till:

$	d	c
3	8	7
1	5	5
5	4	2

or

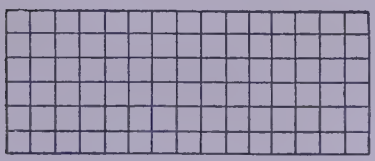
$$\begin{array}{r} 475 \\ 296 \\ \hline 771 \end{array}$$

48. Borrowing in Subtraction. We do not like the use of the words *carry* and *borrow* and if such a device as is outlined above is followed by the teacher it will scarcely be necessary to use these terms at all. They are not appropriate as a description of the processes. It would be better if in addition we teach the children to *exchange* ones for tens, tens for hundreds, etc. By means of the device used above and by the use of the number chart the children will readily perform these processes without the use of the above terms. In subtraction the child is sent to the money drawer or cash register to secure a number of cents less than 10, say 8. If in the compartment there are only two pennies and a nickel he is unable to find 8 cents. His next step is to take a dime and exchange it for pennies. He is now able to obtain his 8 cents by getting one of the pennies and leaving the other nine in the cash drawer for pennies. Let him find out what has happened to the amount of money in the dime box, which in this case may contain any coins less than one dollar. He finds that the number now in this compartment is one dime less than before. Next have him subtract from this compartment a number which would require him to go to the till or compartment next higher in order to get 1 dollar and convert it into smaller coins, which in this case may be 50 cents, 25 cents, 2 dimes, and 5 cents.

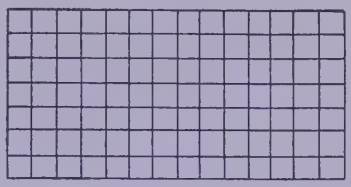
By placing this problem on the blackboard in the form suggested above, the teacher will now experience very little

difficulty in teaching the pupil how to subtract a number from one which appears to be smaller than the number subtracted. He does it by means of exchange — exchanging a larger coin for coins of smaller value.

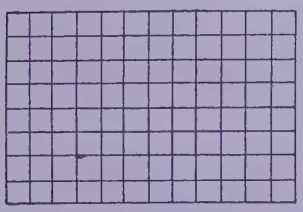
49. Counting. The art of counting should be mastered in this grade and this includes the counting by 1's to 100. Many children in the first grade have already learned this from their play-fellows. The next step is the counting by 2's to 100, or especially to 50, which in this grade will answer the purpose about as well, for the multiplication table is not built farther than 50. They should also be taught to count by 3's to 30, by 4's to 40, and by 5's to 50. They may even count by 5's and 10's to 100. Let them go to the school store and count eggs, by 2's and by 3's, and score the number of dozens, first by counting with one hand and next by counting with both hands as the grocer does. An interesting school game may be made of this drill in counting with both hands. The game of *Buzz-Fuzz* may be introduced here to test the knowledge of the pupils in picking out the 5's and multiples of 5's to 100. The class begins to count, "one, two, three, four, *buzz*, six, seven, eight, nine, *fuzz*, eleven, twelve, thirteen, fourteen, *buzz*, sixteen, seventeen, eighteen, nineteen, *buzz-fuzz*, twenty-one, etc." The child who misses or fails to say the right word is "turned down" and takes his seat. By having the school choose sides an



COUNTING BY 6'S

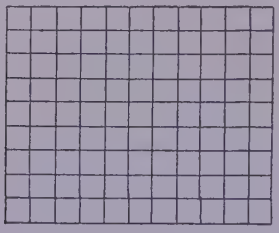


COUNTING BY 7'S

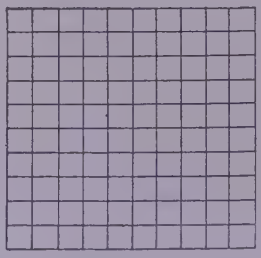


COUNTING BY 8'S

interesting contest is made out of a useful exercise. The same game may be played with 2's and 4's, but it is more difficult and cannot be carried very far in the second grade.



COUNTING BY 9'S



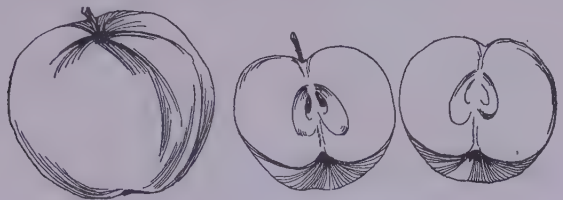
COUNTING BY 10'S

At first use objects, charts or diagrams similar to those given here. This gives the children opportunity to realize just what each sum named is. Without occasional concrete work some children fail to aquire clear ideas of the results named.

50. Factoring. While we will not call the process indicated in the next step by the term *factoring*, that is virtually what it is. We have said that pupils of the second grade should learn all the products to 50. This means that they shall learn both by synthesis and analysis the composite numbers to 50. Here they are: 4, 6, 8, 9, 10, 12, 14, 16, 18, 20, 21, 24, 25, 27, 28, 30, 32, 35, 36, 42, 45, 48, 49. It is noticed that we leave out all products that do not occur in our multiplication table which goes no farther than 9 times 9, and is completed in the third grade. To be sure, there are composite numbers between 1 and 50 which we have not included but they do not occur in multiplication. The child now needs to learn at sight that each number in the above list from 15 to 49 inclusive, is a new product not included in the range of work covered in the first grade. The child must learn to see that 15 is made up of three 5's or five 3's; that 18 is the product of 2 and 9, or 3 and 6; that 21 is the product of 3 and 7; that 24 is the product of 3 and 8, or 4 and 6; and likewise with each composite number in his multiplication table to and including 49.

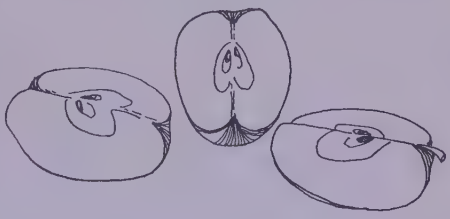
Frequent drills by means of number cards will fix these

factors in mind as nothing else will. This is abstract number work and the child is not assisted very much by

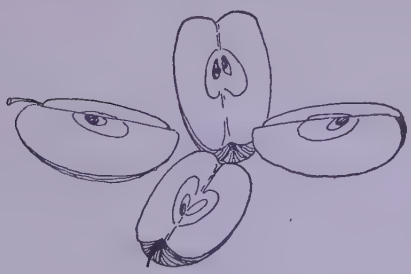


ONE HALVES

means of objects or concrete problems. The first grade is one in which to use the objects and pictures to the best advantage. Due to the fact that the work is abstract, it is more fatiguing than if it appeals to eye and hand as well as to the mental image through sight, or sound, or both. The teacher will find that her pupils will gain accuracy more rapidly through visualization of these number combinations than through oral drills without the presence of the group or combination before the eye. Psychologists have pointed out the fact that most people are eye-minded when it comes to the learning of number processes. It is doubtful if the child gains very much by having to write these combinations and factors instead of being required to repeat them at sight. With a limited number of children the hand-motor image of the number or combination will help to reënforce the visual image. For this reason it is



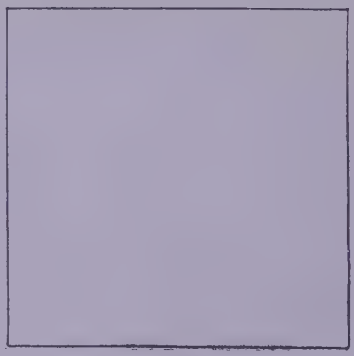
THIRDS



FOURTHS

well for the teacher to require these exercises to be written by all the pupils and by judging the results she may be able to determine which of her pupils will profit most by the written exercise and which by the oral drill.

51. Fractions. In the second grade no processes with fractions should be taught, except as they may be presented objectively, as outlined for the previous grade. The fractions studied should be $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{5}$, and $\frac{1}{8}$, with their multiples. The child may be led to see by means of drawings that $\frac{1}{2}$ is equal to $\frac{2}{4}$, or $\frac{3}{6}$, or $\frac{4}{8}$. Likewise he learns objectively that $\frac{2}{3}$ is twice $\frac{1}{3}$, that $\frac{4}{6}$ is twice $\frac{2}{6}$ or 4 times $\frac{1}{6}$. The point to be fixed in the child's mind in this grade is the relationship that one of these fractions bears to the unit or the relation one fraction bears to another. There is no objection to having the pupil add objectively halves and fourths, or thirds and sixths.



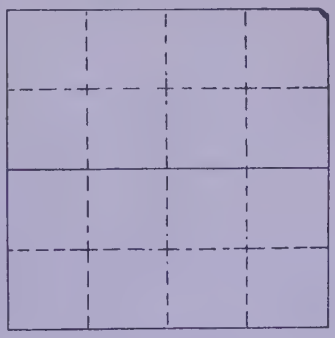
THE UNIT

HALVES

Paper is the best material for illustrating all exercises in fractions. It is inexpensive and convenient and each member of the class can be supplied with material for the exercise. For instance, let a square of paper two inches on a side represent the unit or one. Fold on the dotted line and you have four equal parts; separate these parts on the fold and you have the two halves which make the unit. In a similar way the fourth, the eighth, the third, and other fractions can be taught.

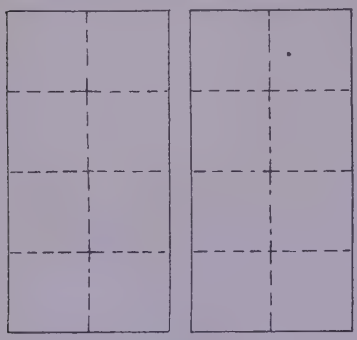
52. Order of Presentation. Teachers in this grade usually wish to know whether they should complete the subject of addition before beginning the subject of subtraction, and whether subtraction should be completed before multiplication and division are taught. On this point we wish to say that during the first two grades these processes should be more or less inseparable. Subtraction is the reverse of addition. Multiplication is a shortened process of counting by 2's, 3's, 4's, 5's, etc., and division is a separation of these products into their factors again. For these reasons the first two years should be devoted to the mastery of the art of counting in all these various ways and the mastery of the use of the symbols standing for the results of such counting. If the teacher is wise in her use of objects and pictures in presenting these number facts and wise in her transition from the concrete expression to the abstract symbolization, she will find that in the third grade the pupils are ready to learn real multiplication involving the multiplication of any number by any other number, or the division of any number by any other number. At this juncture it becomes necessary again to swing away from the abstract number processes to such concrete problems as grow out of the actual experiences of the race.

53. Arithmetic as Ratio. The second grade is the logical place for sense-training by means of blocks, to teach pupils to employ not only the sense of sight but the sense of touch in determining size and ratio. Pupils may be given cubes and oblongs, or rectangular prisms of the same basal dimensions but differing in length by multiples of the basal unit. One block is an inch cube, another a two-inch rectangular prism, another a three-inch rectangular prism, and so on to one which

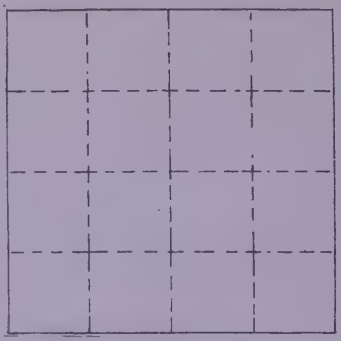


SIXTEEN FOLD

is twelve inches in length. The blocks may be cylindrical and bear the same ratios to each other. The pupil is taught to visualize these and to determine the ratios of each to each. This is a game he likes and it is good as eye-training. He should be taught to write the ratios as he sees them. Following this visualization he should learn the same relationships by means of the touch, either when he is blindfolded or when the blocks are placed in his hands at his back. Some writers claim that this is a method of teaching fractions, but a fraction is one or more of the equal measures of which a unit, or one, may be made. In other words, a ratio is a fractional expression applied to *multiples* of numbers, while a fraction expresses the ratio of *parts less than the whole.* A mixed number is composed of a whole number and a fraction. In the fraction $\frac{3}{4}$ we have the ratio of 3 : 4. It is best not to confuse the mind of the child in the primary grades with any such distinction. In his fractions he should be confined to the fractional parts of the unit. A little later in his course he may apply the larger principle of ratio to the division of numbers composed of more than one unit, such as finding $\frac{1}{5}$ of 40, $\frac{3}{8}$ of 80, etc.



TWO EIGHTS



SIXTEENTHS

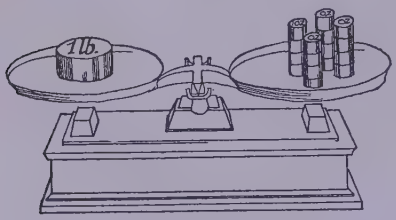
Folding and cutting paper is an excellent exercise for teaching ratio. How many 8's in 16? What part of 16 is 8? How many 4's in 16? What part of 16 is 4? What part of 16 is 12?

54. Vocational Problems. In the second grade some of the concrete problems may deal with vocational subjects and the daily experiences of the grown-ups of the family. It should not be forgotten that arithmetic is not to be applied to the experiences of children so much as to the experiences of adults. It is evident then that nearly all of the concrete problems given the child of any grade must deal in the main with the experiences of his father and mother, his brothers and sisters, and the storekeeper around the corner. The school store plays a very important factor in furnishing the school problems of this character. The pupil is sent to the school store to purchase various articles amounting to 50 cents or less. He is supplied with money of different denominations and is required to be able to tell the storekeeper how much "change" he must have in each purchase. He is required to buy several articles and determine the sum of the purchase prices. He is required to go to the school store to exchange any coin for such other coins as he determines he should have in exchange. For example, he has a 50-cent piece and expects to sell newspapers on the corner at a penny apiece. He knows he must have change in his pocket so that when passers-by offer him nickels, dimes, or quarters, he can make change in order to make the sale. Let him work this problem out.

PURCHASING EGGS

Let each child in turn take his place as storekeeper. He must keep account of sales and must start the day's business with a given amount of cash on hand. Let him find two ways in which to determine the amount of his sales during the day or the period. He can either put

down the amounts of the sales as they are made and find the sum or he can count his money at the close of the day and subtract from the sum the amount of money he had at the beginning for the purpose of making change. He will soon discover that he needs to do both in order to keep a check upon his accuracy. Various problems may be worked out in this way.



THE STORE SCALE

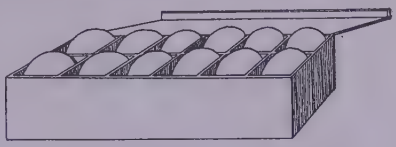
Each pupil is required to make *several* purchases in one trip to the store. He is then to make a problem growing out of his experience and give a written solution of the same. He is required to express this problem in a language exercise and likewise to explain its solution. The average child of this grade will take a surprising interest in playing store.

55. Variety of Problems. The teacher should be supplied with copies of all the latest text-books containing exercises for primary schools, for in them she will discover many interesting suggestions and type problems. As in the first grade, she should be resourceful and resort to the frequent use of blackboard drawings and pencil sketches.

56. Measuring. In this grade the pupil should learn to measure by means of the foot-rule and the yardstick, and to weigh by means of the avoirdupois scales. If the suggestion made in the outline of work for the first grade is carried out, there will be a white line painted along the top of the blackboard where the pupils will unconsciously gain an accurate impres-

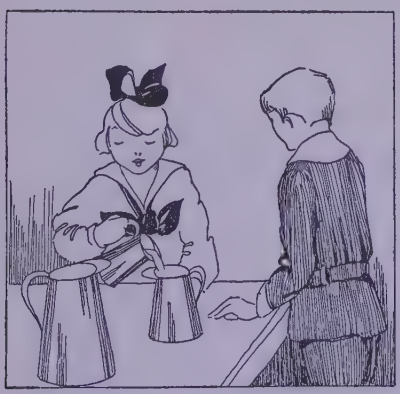
USING THE SCALE

sion of the length of a foot, a yard, and a rod. Pupils of this grade may be taught to make problems for each other in measuring. In addition to the use of the foot-rule and the yardstick they should have practice in weighing articles on the school scales. Each building should be provided with such an equipment. Articles given to the pupils to weigh should be such as will not be soiled nor spilled nor injured by frequent handling. Potatoes and small pasteboard boxes filled with various articles used in the school store, may be weighed. Books may be weighed, and the amount of parcel postage required on any package may be computed, using merely the minimum rate for parcel postage, which means the rate of the first zone or both. Pupils of this grade may even learn that when they take a package to the post office to mail it for Mamma, the distance the package is to be carried would determine the amount to be paid, if that distance is over 75 miles for some classes of articles, and over 150 miles for others. The work here outlined should be extended for the third and fourth grades.



EGGS ARE SOLD BY THE DOZEN

(a) Dry and Liquid Measures. The pupils should learn concretely the use of the pint, quart, half-gallon and gallon, in liquid measure, and of the quart, peck, half-bushel, and bushel in dry measure. Nearly all text-books omit the use of the half-gallon and half-bushel but they are very essential in practical experience. A quantity of dry sand kept in the school store may be used for both dry measure and



TWO PINTS MAKE ONE QUART

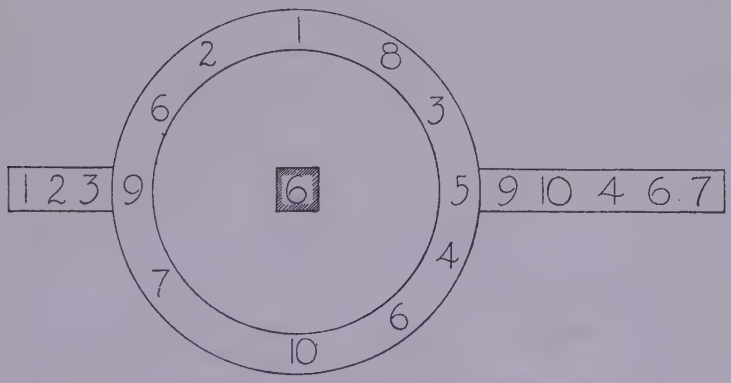
liquid measure. Occasionally water may be used in measuring from one vessel into another but it is less satisfactory than the sand because of the danger in spilling. Children should be given frequent exercises in measuring quantities in all these ways. The teacher will find it very helpful to give her pupils in second grade, during the latter half of the year, numerous concrete problems requiring actual measurements.

MEASURES USED IN SELLING MILK

57. Devices for Drilling in Multiplication. Mention has already been made of the value of the Number Cards and sight drills. The teacher frequently finds herself unable to find time to prepare a sufficient variety of problems for abstract drills, and so she will welcome a device such as shown on the following page:

Draw a large circle on a piece of white cardboard, well glazed to prevent its soiling easily, with a diameter of not less than 12 inches. Draw another circle within this with a diameter of 10 inches. This will leave a white band one inch wide. Within this band print the figures 1, 2, 3, etc.,

to 10. In the center of the circle cut two vertical slits 2 inches long and 3 inches apart. On a strip of cardboard $2\frac{1}{2}$ inches wide print the figures 1, 2, 3, etc., to 10. Pass this strip through the two slits so as to show one figure at a time as the strip is drawn through. The teacher uses the numbers as they appear as the multipliers, and the figures in the rim of the circle as the numbers to be multiplied. For each time a figure appears in the center of the circle,



A GOOD DEVICE FOR DRILL EXERCISES

she has ten problems in multiplication on the wheel. The same device may be used for addition and the same plan with a different wheel for division.

Caution. It must not be forgotten that the various exercises with number cards described in preceding pages are exercises designed to fix in the child's consciousness the results of the fundamental processes up to a limited minimum of assigned work. The multiplication required by these cards and drills is not the kind of multiplication required in solving real problems. However, the multiplication taught in this way is fundamental to the more extended abstract multiplication. When the child undertakes to multiply 86 by 24 he has altogether a different type of problem. In the second grade he may be introduced to this kind of multiplication but should not be

given problems involving more than one figure in the multiplier until the latter part of the year when the teacher may teach the multiplication by numbers of two figures including 2, 3, 4 and 5. If the child at the end of the second grade can multiply by these figures and can do it with almost unerring accuracy he has accomplished enough to satisfy our demands.

The following problem may illustrate the method to be used in teaching multiplication in this grade:

265	265
4	31
20	265
24	795
8	8,215
1,060	

In introducing multipliers of two figures, always use numbers ending in 1. It is easier to multiply by 31 than by 13.

58. Division. The work in multiplication leads directly to division. The principles of division should have been well taught in first grade, but applied only to such problems as $3\overline{)12}$, $2\overline{)10}$, $4\overline{)12}$, $3\overline{)9}$, etc., as the reverse of the multiplication taught. There is no objection to the teaching of the sign of division, ÷, now. By use of the drawings shown on page 246 for illustrating fractions, the teacher may call the circle 12 and divide it into 4ths, or 24 and divide it into 3rds, 4ths, 6ths, or 8ths.

DIVIDING INTO EQUAL PARTS

During the second grade, the work in division should not extend beyond the division of composite numbers up to 100 by single figures as divisors. The teacher should exercise great patience and not expect too much of her pupils. If the work in drilling upon the 31 composite numbers named on page 280 has been well done, short division will prove an interesting subject to the pupils.

THIRD YEAR

59. Reviews. There are two reasons for reviewing at this point the work of the first two years. The review is necessary in order to fix the facts and principles in mind. The teacher should review the directions in this manual in order to fortify herself along the line of methods of presentation and familiarize herself with certain more or less recognized boundaries for the course of study. The pupil must be taken over much of the ground of subject-matter as it deals with the four fundamental operations and the elementary processes in each.

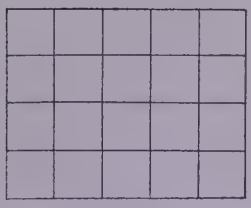
(a) PREPARATION FOR TEXT-BOOK. There is still another reason for a thorough review now on the part of the pupil. This is the grade in which the use of the text-book is usually begun. The teacher of the third grade will find her pupils have not all grasped the subject of arithmetic with the same degree of tenacity. They have been taught orally up to this point and some of them have not retained as much as others. It would be unwise for her to begin the use of the text-book until she has assured herself of a reasonable degree of evenness in the preparation of her pupils, for from this time on each pupil will be expected to depend more and more upon himself to interpret the meaning of his problems. Up to this time his work has been largely oral, and the teacher has been the source of the problems. He will now need to be given much instruction and many drills on the reading of problems, which is merely another way of saying that he must learn to interpret the meaning of written problems.

(b) THOROUGHNESS. *These reviews* should be thorough and be of such a nature as to test every principle previously covered. The 45 combinations in addition should be fixed in mind, for a review of these ought never again to be necessary. The reading and writing of numbers to 1,000, or any number of thousands, should be included in this review. The multiplication table as far as built up, perhaps to 7 times 7 and 8 times 6, should be made the subject of reviews in frequent drills. Short division to $49 \div 7 = 7$ should bring as instantaneous response from the pupil as $7 \times 7 = 49$. The simple exercises in concrete drills in fractions may require several days also. The compound denominate numbers as far as taught by actual measurements should be reviewed in order to prepare the pupil to complete the study in this grade.

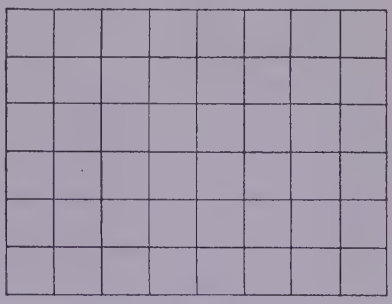
(c) TIME REQUIRED. All this will require time — perhaps until Thanksgiving, perhaps in some schools not so long. The work must be largely oral until Christmas, although the amount and difficulty of the written work should increase steadily. When the child has learned to write numbers of four figures from dictation and to read them without aid, he has almost mastered the subject of reading and writing numbers. It is an easy approach to millions and billions and trillions. The child rejoices in his new-found power to talk about billions and to write billions. He probably can easily learn to read and write a million and any number below that during the third year. He will not need this knowledge, however, in solving any of the problems of business and industry. There is therefore very little reason for teaching the "orders" of numbers to vigintillions. Our counting always extends far beyond our needs in computation.

60. Work in Multiplication. Too much emphasis cannot be placed upon the completion of the multiplication to 9 times 9 in this grade. To memorize the tables in the old way is very uninteresting and irksome to most children. They can hardly see the reasons for having to do it, and

yet many a child has been "kept in" or otherwise punished for his failure to "say the 7's" correctly. If he is taught to *build* the table through the process of counting and grouping objects or drawings, the results will become more firmly fixed and fixed at an earlier date because the child has been led to see the relations. Here is a device for teaching multiplication that is objective and illustrative:



5 TIMES 4



6 TIMES 8

Have the pupils draw squares on the blackboard representing 2×3, 3×3, 3×4, 4×5, 4×7, 5×6, etc. They count the number of squares in one row, then the number in two rows, the number in three rows, etc., until they begin to put down the results thus:

4	8
4	8
4	8
4	8
4	8
20	8
	48

They count the number of 4's or number of 8's and they get the result, 5 fours or 5×4 are 20; 6 eights or 6×8 are 48. They are now ready to build a multiplication "table" or "square" as large as the teacher may suggest, but 10×10 is far enough. In fact, if a child can multiply 9 by 9 and

all the multiplications of the table below 81, he can multiply any two numbers consisting of one figure each. The following table is the result of the pupil's own efforts along this line.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

There are in all only 81 squares or numbers here, but it will be seen that the numbers in the first column and in the first line are *not* products and may be eliminated. This reduces the number to 64. But there are several repetitions in these 64 squares, because six 8's are the same as eight 6's, etc. Eliminating all repetitions we have 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 24, 25, 27, 28, 30, 32, 35, 36, 40, 42, 45, 48, 49, 54, 56, 63, 64, 72, 81, or 31 numbers in all. If the pupil masters these 31 products, or composite numbers, he is safe on the multiplication table. Then why should we not learn to place the emphasis where the difficulty is? To learn to spell, why should we not give more

attention to the elements that make a word difficult, and to the more difficult words? Why give so much time to the multiplication? As William Hawley Smith says, "Let us put the grease where the squeak is."

Here are these 31 products analyzed:

$4 = 2\times2$
$6 = 3\times2$
$8 = 4\times2$
$9 = 3\times3$
$10 = 5\times2$
$12 = \begin{cases} 4\times3 \\ 6\times2 \end{cases}$
$14 = 7\times2$
$15 = 5\times3$
$16 = \begin{cases} 8\times2 \\ 4\times4 \end{cases}$
$18 = \begin{cases} 6\times3 \\ 9\times2 \end{cases}$
$20 = 5\times4$
$21 = 7\times3$
$24 = \begin{cases} 6\times4 \\ 8\times3 \end{cases}$
$25 = 5\times5$
$27 = 9\times3$
$28 = 7\times4$
$30 = 6\times5$
$32 = 8\times4$
$35 = 7\times5$
$36 = \begin{cases} 9\times4 \\ 6\times6 \end{cases}$
$40 = 8\times5$
$42 = 7\times6$
$45 = 9\times5$
$48 = 8\times6$
$49 = 7\times7$
$54 = 9\times6$
$56 = 8\times7$
$63 = 9\times7$
$64 = 8\times8$
$72 = 9\times8$
$81 = 9\times9$

Then there are but 31 composite numbers to learn in order to master the multiplication table. There are only five of these that have more than one set of factors to learn, 12, 16, 18, 24, 36.

The child has already learned that four 3's are the same in quantity as three 4's and so on through the 22 products resulting from apparently two sets of factors each, but in reality these 22 numbers are about as easily learned as 2×2, 3×3, 4×4, 5×5, 6×6, 7×7, 8×8, and 9×9. We now have the entire 64 composite numbers analysized. Twenty-two occurs twice (44). 8 of them are squares of themselves and five of them have two sets of factors each.

61. Making Change. To drill on subtraction and making change, use the numbers in the columns below as the amounts of purchases.

10	37	18
18	28	29
9	42	38
19	18	47
12	29	56
16	41	65
8	14	74
7	22	83

Find the amount of change in each purchase and the probable coins one would receive as "change." Here are scores of problems in one brief table. The teacher can make many more. In the latter part of the third grade the teacher may make the amount offered in payment of each bill $1.00, $2.00, $5.00, $10.00, and require the pupils to bring back the correct change. Teach them to *subtract* by counting thus: For the first problem in the second column, 37, 40, 50, putting to one side the 3 cents and the dime.

In addition where columns of numbers consisting of three or more figures each are to be added, the following form is best calculated to show the pupil how the addition

of figures in the tens column makes a sum of *tens* and how the addition of figures in the hundreds column makes a sum of *hundreds*:

344
658
296
454
729

31
250
2200

2481

In adding, he finds there are 31 *units*, and he writes 31 in units' column. He likewise finds the sum of *tens* to be 25, and he writes 25 as tens in tens' column, making 250. He finds the sum of hundreds to be 22 and he writes this as hundreds, in hundreds' place. He has now reduced all the sums to units, and proceeds to add them and he finds he has 2481 units or 2,481.

62. Multiplication by Two or More Figures. In teaching multiplication by two or more figures, the following method is sound in principle and plain in practice:

345	456
4	21 = 20 + 1
20 = 4 × 5	456 = 1 × 456
160 = 4 × 40	9120 = 20 × 456
1200 = 4 × 300	9576 = 21 × 456
1380 = 4 × 345	

In these exercises the × is read *times*. Since the main work of the third year will be the teaching of multiplication and division, it will be well for the teacher to proceed slowly but safely. Again, much value must be attached to *drill*, rather than to an effort to get the pupil to see *why* we do thus and so. The philosophy of these abstract processes will become his inheritance later.

It will not be long until the pupil will be able to see that the ciphers in the partial products are unnecessary and may be omitted.

It may be thought by some teachers that the multiplication table should be taught to and including 12, as it is in England. We have followed this practice in this country long enough, for we have no need of it here as people do in England, where the monetary system requires calculations involving 12 as a factor.

63. Division. (a) Short Division. Division by one figure should be taught orally, with dividends of two and three figures. At first choose only such dividends and divisors as will permit of even division, such as 4)84, 3)69, 2)48, 3)693, 4)848, etc.

The next step is to choose dividends in which the divisions are not even, except for the last figure, thus:

2)58, 3)54, 4)76, 2)358, 3)579, 4)756, etc.

These exercises and drills should extend over the work of several weeks.

The next step in short division is the introduction of dividends leaving a remainder.

(1) I wish to divide 25 cents among 6 boys, giving each one the largest number of cents possible. How much will each boy receive and how much will I have left?

(2) Divide 35 apples among 4 boys giving each one as many as possible. *Divide all the apples.*

(3) Three boys found 14 marbles and agreed to divide them equally among themselves. What should be done with the marbles left over?

(4) What is the quotient and the remainder of 35¢ ÷ 3¢?

(5) Find the quotient and the remainder of $185 ÷ $4.

(b) Long Division. Long division may be introduced into this grade during the latter part of the school year. The teacher should not allow any other portion of the work herein outlined to suffer to make room for long division, for it *must* wait until the class is ready for it.

The first problems in long division should consist of evenly divisible dividends and divisors of one figure.

```
4)796(199        3)768(236
  4               6
  39              16
  36              15
   36              18
   36              18
```

Much drill in problems of this type must be given. Explain that the only difference between a problem of this kind and one of the same number of figures as shown in short division above, consists of a difference of form, a difference in the way results are indicated. Pupils usually find these problems less difficult than those in short division, for the reason that all the processes here are written down and none carried mentally, as in short division.

The next step is to take problems whose quotients will divide evenly but whose divisors consist of numbers of two figures each, such as 21, 31, 41, 51, 61, etc. The reason for this is apparent — there is nothing to "carry" when the first figure of the divisor is multiplied by the figure of the quotient. In other words, the pupil is not required first to find a "trial" quotient. He drops the 1 mentally and divides the first figure of the divisor into the first figure or first two figures of the dividend, and so on.

Numerous drills of this kind will prepare the pupil to divide by *any* number, but this is work for the fourth school year.

64. Written Work. The teacher should insist upon neat and accurate written work. Blackboard work should not be exempt from this rule. Habit in this matter is fundamentally important.

65. United States Money. This is the grade in which the subject of United States Money should be studied thoroughly. Pupils should learn how to reduce cents to dollars and dollars to cents. They should learn how to use the period in all problems in United States Money — as applied to addition, subtraction, multiplication, and division. It will be necessary for the teacher to offer many problems in money.

66. Conclusion. The teacher should not forget that she is preparing her pupils for a much more formal course in arithmetic in the fourth grade, and she must never lose sight of the fact that accuracy must always be her goal. She must never sacrifice accuracy for speed.

TEST QUESTIONS

1. State some of the criticisms brought against the teaching of number in the primary grades. Are these criticisms warranted?

2. What are some of the causes of the poor work in arithmetic in the primary grades?

3. Why should we teach number in the first grade?

4. What are some of the elements of waste in teaching arithmetic?.

5. What are the best sources of problem material?

6. What do you understand by the number consciousness?

7. How does the number concept originate?

8. Distinguish between devices and methods.

9. Why should we use objects before symbols? What danger may arise from the use of objects?

10. Of what value are games in teaching number in the primary grades?

PLANS FOR TEACHING PRIMARY NUMBER WORK

MAME ESTELLE MYERS

FIRST YEAR

SEPTEMBER

Note: The work for the first two or three months should consist largely of games, the object of which is to train the special senses, thus enabling the child to comprehend numbers more readily. Most children can count to twenty before they enter school, but they do not associate the number with the group it represents; hence, this must be taught.

In the chapter on *Number*, Dr. Williams has laid the foundation for teaching this subject in a remarkably clear and forceful manner. Every teacher is urged to study his *Introduction*, in which the pedagogy of the subject is clearly set forth. If teachers understood the underlying principles here discussed, much better results would be obtained in primary arithmetic than are now secured in most schools. Another matter to which the teacher's attention is directed is that of duplications in addition and multiplication. The teacher should constantly refer to this chapter in planning her number work for the first, second and third grades.

1. First Week. Play a game with three or four colored balls. Lay them on the table before the class. Let the pupils observe the balls, then close their eyes. Remove one ball. Let the pupils open their eyes and tell which one is gone. Rearrange the balls and repeat the game. Call some pupil to take a ball while the rest shut their eyes. Let the class tell which ball the child took. Repeat several times.

Have rods, strips of colored paper, or rulers of different lengths. Hold one before the class and ask what they see. The answer may be, "I see a long stick." Hold a short one before the class to secure the statement, "I see a short stick." Then hold up the two together and ask the class to describe them. One may say, "The first stick is the larger; the second stick is the shorter." A third stick may be introduced and the terms "longest" and "shortest" taught. Play a game by letting one child at a time come to the desk and draw a stick from beneath a cover. Let him tell what stick he drew.

The pupils may compare objects in the room — pieces of chalk, ribbons, strips of paper, etc.

Let the class go to the board and draw a short line. Ask them to draw one a little longer, then another, longer or shorter than the first. In this way teach comparative lengths.

Have blocks of different sizes. Ask if the blocks are alike. Have

the pupils describe them. Later give each child several blocks of two sizes. Blindfold him and let him sort the blocks by feeling of them, putting the large ones in one pile and the small ones in another. Remove the blindfold and let each discover his mistakes. Then ask the children to hold up *one* block; *two* blocks; *three* blocks. Build a house with the three blocks; then let the pupils go to the board and draw the three blocks.

2. Second Week. Have circles cut from red, blue and yellow paper mounted on white cards. Hold up each of the colors, one at a time. Ask the pupils to name the colors. Teach the names of the colors if the pupils do not know them. Hold up the three cards with the backs to the class. Let the pupils come one at a time, draw a card and tell its color.

Later hold up two cards of different colors. Let the class observe an instant. Remove the cards and let some pupil name the colors in the order seen. Repeat several times; then use three colors.

Teach the meaning of *circle.* Have circles of different sizes cut from colored paper. Let the pupils compare them. Hold up two nearly of a size, and see if the class can tell quickly which is the larger. After this exercise, hold up two circles and ask how many there are; then hold three, four or five. Show them for just a moment and then remove them from sight. Let the pupils make as many dots or lines on paper as there were circles. Have the class name familiar objects shaped like a circle. Count the round articles in the room. Let the pupils cut stenciled circles and make circular penwipers.

Play the game with the blocks of different sizes. Blindfold the pupils and see who can sort a pile of blocks of two sizes or of two weights in the shortest time.

Let the pupils string colored beads as directed — one red, one yellow and one blue, making groups of threes. Repeat.

Let the pupils go to the board. Tell them to draw a short line, then one a little longer, and one still longer. Erase the longest line; the shortest. Draw a line twice as long as the one left on the board. Erase.

Have the color cards in hand. Show one an instant. Let the pupils turn to the board and make as many short, vertical lines as there were colored circles on the card. Do not have more than four circles on a card.

3. Third Week. Show the class a square of colored paper. See how many know what it is. Let them fold a square from a paper oblong. Let them count the number of sides it has and the corners. Have them lay squares with straws or toothpicks. Let them name objects shaped like a square; then let them go to the board and draw squares.

Play a game by blindfolding the pupils and giving them three sticks or straws of different lengths. See who can arrange these according to their length in the shortest time. The game may be continued by adding one or two more sticks to the list, mixing them up and letting the pupils try again. Commend those who do well for "seeing so well with their fingers."

Fold squares of paper to represent handkerchiefs and napkins. Construct a picture frame.

Play the game with blocks of different weights. Blindfold the class and let them sort the light blocks and the heavy ones. Let each count the blocks of each kind that he has.

Play a game with three or four of the color cards. Hold them in a group before the class for an instant, and let them observe. Remove the cards and let the pupils name the colors in the order in which they were seen. Repeat several times. Vary this by mixing the cards after the class have observed them and letting one of the pupils arrange them in the order seen.

Play another game with the color cards. Let the class go to the board. Show one or two cards at once. Let the class make as many vertical lines on the board as they see colored circles.

4. Fourth Week. Teach the form of an oblong. Let the class build an oblong with sticks. Count the sides and corners. Build a square below the oblong. Tell how the two forms differ. Name common objects that are the shape of oblongs. Make oblong booklets by creasing squares of paper through the center and sewing through the crease. After folding the first sheet for the booklet, ask the class which is larger, the square or one of the oblongs formed by creasing it. How much larger is the square? What part of the square is each oblong? How many halves in the whole square?

Have pasteboard oblongs, squares and circles. Play a game by blindfolding the pupils, giving them a handful of these forms. See who can separate them into three piles in the shortest time. Play another game with the forms. Draw on the board several squares, circles and oblongs. Let the pupils look at the drawings a moment, then erase and ask them to arrange the same number of squares, circles and oblongs on their desks.

OCTOBER

5. First Week. Let the pupils go to the board and draw a small oblong, one that is larger, and another still larger. Have them point to the largest, then to the smallest. Erase. Let the pupils draw a small oblong, then one twice as long. Have them draw a straight line, then draw one half as long, and one shorter than the second line. Let

them point to the shortest line; to the longest one. Also construct these oblongs of paper.

Teach the form of a triangle. Let the pupils build one with toothpicks or straws. Let them count the sides and corners. Show the difference between a square and a triangle. Let them cut the forms from paper. Let them build a square and a rectangle and see how both figures can be divided into triangles by using a diagonal line. Let the class fold paper squares and oblongs. Crease so as to divide them into triangles. Have the class make triangular boxes; also pinwheels from a square divided into triangles by its diagonals.

Play the game with the pasteboard figures again, and add triangles. Blindfold the pupils and give each a handful of pasteboard circles, oblongs, squares and triangles. Let the class sort these forms.

6. Second Week. Have different members of the class point out *one* book, *one* eraser, *one* chair or *one* flower. Ask the class to tell what can be bought with 1 cent. Write the figure 1 on the board and tell the pupils what it is. Later let them make it. Let the class string beads, using *one* bead of each color; repeat the series.

To teach the pupils to see readily the differences in areas, have circles and oblongs of different sizes. Hold up two oblongs and ask which is the larger. After several trials, hold up two nearly of a size, and see who can detect the difference first. Repeat the exercise, using circles in place of the oblongs.

Blindfold the pupils and give each one two or three familiar objects. See how quickly each can recognize what was given him by feeling of it.

Play a "sharp eyes" game. Have three articles on a table covered. Remove the cover, let the class look at them for a moment, then re-cover the articles and have the pupils name them in the order seen. Repeat several times. Then disarrange the articles after the class have seen them and ask one of the pupils to fix them in the order previously arranged. Gradually increase the number of objects until the pupils can remember the order in which six or eight are seen.

Teach the form of a cube. Talk of the shape of each face, the number of faces, corners and edges the object has. Name familiar objects similar to the cube.

7. Third Week. Teach the square prism. What kind of faces has it? How many of each kind? How many corners and edges has it? What objects are similar in form? Have a basket with cubes and prisms in it. Let the children come one at a time, each shut his eyes, pick up a model and tell what he has, without opening his eyes.

Later, call on several pupils one at a time to go to the basket, pick up two cubes or two prisms and lay them on the table. Then pass the pasteboard forms. Let each pupil place two circles, two oblongs and two squares on his desk. Pass the colored beads, and let the class

string two of each color. Ask what can be bought with 2 cents. Let the children build squares and oblongs using two sticks of the same color. Let them find how many ones in two, and what remains when one is subtracted.

Have a number of small pasteboard boxes filled with different materials and securely tied. The boxes may contain sand, bran, small nails, grain, salt, etc. Blindfold the pupils and let them arrange these boxes in order of their weight. Begin the lesson with three boxes; gradually add others.

Play a game with the color cards. Hold three before the class for a moment. Let the children name the colors in the order seen. Add one color and repeat several times. Finally use the six colors. The cards may be arranged in a row on the desk. After the class have looked at them a moment, change their order and ask the children to put them back in their original order.

8. Fourth Week. Teach the forms of a sphere and a triangular prism. What objects are similar to each. Count the edges, corners and faces of the prism. What is the shape of each face?

Pass the pasteboard forms. Ask the class to place three circles on their desks. Beneath them arrange three oblongs, then three squares. Ask different pupils to show the class three erasers, three pieces of chalk, etc. Write the figure 3 on each desk. Let the pupils cover them with pegs, then trace with their fingers. Later let the class go to the board. Write a 3 for each one. After tracing it with chalk, let each child make several.

Play a game with the color cards. Show one, two or three cards at once. Let the pupils observe a moment, then remove the cards and ask the pupils to draw on paper as many circles as they saw on the cards. Beneath each drawing have them write the number.

Let the class play another game. Give them each an assortment of dominoes, cubical blocks and checkers. Blindfold the class and let them sort the blocks and arrange three of each kind in a row.

NOVEMBER

9. First Week. Play the "sharp eyes" game. Have several articles on a table covered. Remove the cover a moment and let the pupils observe. Cover, and ask them to name the objects in the order seen. Repeat several times. One child may arrange the objects while the class close their eyes. After observing the new arrangement an instant, they may close their eyes while the child hides one or two articles. Let the rest tell what is gone.

Have a counting exercise. Let the pupils count the girls in one row, then the boys. Let them count different objects in the room.

Let them compare the pupils in the class in regard to height and size. Which boy is the tallest? Which girl? Who is the largest boy? The largest boy and girl? Then compare two boys, two girls, a boy and a girl, using the terms taller, shorter, larger, smaller.

Give the pupils the boxes or blocks for teaching differences in weight. Let the class sort them and arrange according to weight.

Teach the form of a cylinder. Let the class name objects similar in form. Call attention to the shape of the bases. Let the class string wooden beads, using three cubes, three cylinders, three spheres and three square prisms.

Teach the number 4. Let the class arrange on their desks four red toothpicks, 4 blue, 4 yellow, 4 orange, 4 green and 4 violet ones. Let them build squares of each group. Ask different pupils to find 4 objects alike, as 4 cards and 4 pictures. Have cards with illustrations on them of the four numbers taught. Play a game by holding up one card after another, asking the pupils to tell the number at once.

Give the class toothpicks. See in how many ways they can arrange four of them. Ask the class how many 2's there are in 4. Let them make the figure 4 with toothpicks. Send the children to the board. Make a figure 4 for each child, and after tracing it several times, have them make a number of 4's.

10. Second Week. Use the six color cards for a sight-training exercise. Arrange four cards in a row on the table. Let the class observe a moment. Quickly collect the cards, change their order and call a child to rearrange in the order seen. Repeat several times, finally adding the other two colors.

Review the numbers already taught by holding up groups of colored balls or sticks to represent them. The children should be able to call each number as soon as the group is seen. Then use the cards illustrating the numbers, which the children should recognize quickly.

Pass blocks. Have the pupils hold up one block, three blocks, two blocks, four blocks.

Let some child count the seats in two rows; in three rows. Let them count other objects to twenty.

Teach the number 5 as the other numbers were taught. Have the class arrange different objects in groups of five. Let them string beads, using five of each color. Use blocks or the pasteboard squares and build all the numbers they have learned. Teach the class to write the figure 5.

If time permits, give other sense-training exercises.

11. Third Week. Make cards illustrating by different grouping of circles the numbers learned thus far.

Present these to the class and have them give the number represented instantly.

Have the class string beads, using one red, two blue, three yellow, four orange and five green ones. Repeat the series.

Teach the number 6, and how to write it. Give the pupils objects to count. Let them find how many twos, threes and sixes in 6. Let them arrange 6 toothpicks in as many ways as they can. Use a paper oblong and teach the class how to divide it into thirds and sixths. Count the twos and threes in 6. What is each square called? Have cards illustrating the various combinations that make six. Drill carefully on these until the class recognize them at once.

Introduce six-inch rulers. Explain what they are and what the long marks represent. Give exercises in drawing horizontal lines 3 inches, 5 inches, 1 inch, 4 inches and 6 inches long. When the class can do this well, have them draw a six-inch square, two-inch square and one-inch square. (See page 254.)

12. Fourth Week. With the cards illustrating the numbers learned give a rapid drill on the recognition of number groups.

Let the pupils use their rulers and draw an oblong 6 inches long and 4 inches wide. Show them how to place a dot every 2 inches on each line and to connect these points. How many squares are there? How big is each one? How many twos in 6? How many threes?

Draw a six-inch square. Place a dot at the middle of each side and connect. How large is each square? How many twos in 4? What part of 4 squares is 2 squares? What part of 6 squares is 3 squares? Count to 6 by 2's; by 3's.

Repeat one of the ear-training exercises and one of the feeling games.

Teach the number 7, using a variety of objects. Show the pupils how to write the number at the board. Have the class draw a line 7 inches long, one 6, one 5, and on down to 1. String beads, using 7 of each color. Ask how many pupils are seven years old. Ask how many days in a week. Have some one name them. Have another name the days we are in school. How many are there? What days are we at home? How many are there?

Use cards illustrating the various combinations of 7 to impress the number on the pupils' minds.

DECEMBER

13. First Week. Give a rapid review of the numbers already taught by means of the illustrated cards.

Play a game by blindfolding the pupils, giving them a number of pasteboard squares or circles of different sizes, and having them arrange these according to size.

Play the game with the color cards to train the eye.

Teach the number 8 in the way suggested for teaching previous numbers; then teach the class to write the figure. Have illustrated cards showing the different combinations of 8. (See page 236.)

Have the class draw oblongs 8 by 4 inches and divide them into 2-inch squares. How many 2's in 8? Count by 2's to 8. (See page 230.) How many 4's in 8? What is half of 8 squares? What is one-quarter of 8 squares?

Have counting exercises. See how many can count to thirty, using objects.

Have a measuring exercise. Let the class measure books, tablets, boxes, sheets of paper, etc. Let them draw lines 8 inches long, 7 inches long, and so on down to 1.

Let them string beads, using one red, two blue, three yellow, etc., until eight of one color have been strung.

14. Second Week. Let the pupils count to 50. Use the illustrated number cards and see how quickly they can tell the numbers. Let the class arrange pasteboard squares to illustrate each number to 9.

Have the class draw an inch-square; also oblongs an inch wide and of sufficient length to divide into squares to represent the numbers taught thus far. Place the oblongs one under another so as to form stairs when completed.

Blindfold the pupils and give several sticks of different lengths to each. See who can arrange them first in order of length.

Teach the number 9, and show the pupils how to write it. Have them arrange 9 objects in as many ways as possible. (See page 236.)

Rapidly sketch on the board simple objects in different arrangements to represent the numbers taught. The children should be able to recognize each number group at once.

Let the class arrange toothpicks or pegs to represent all the numbers learned.

Have them draw a 9-inch square and divide it into 3-inch squares. How many 3's in 9? What is one-third of 9? Count by 3's to 9.

Construct a chair or table. (See *Construction Work*, Vol. I, page 492.)

15. Third Week. Give a thorough drill on recognizing groups of objects or pictures up to 10. Pay special attention to any troublesome combinations.

Teach the figure 10. Divide an oblong 10 by 4 inches into 2-inch squares. How many 2's in 10? How many 5's? Count by 2's to 10. How many squares in half of 10? In one-fifth of 10? In one-tenth of 10? Have ten circles placed in different combinations on cards. Show these for rapid recognition of the number. Ask what coin is worth 10 cents. (See page 237.)

Give some of the ear and eye-training exercises. Let the class

string beads, using one color to represent each number taught, beginning with one red bead and ending with ten beads of another color. By the use of objects, test the pupils in counting to 80 with objects.

JANUARY

16. First Week. Blindfold the pupils, give them beans and let them arrange groups to represent the ten numbers learned.

Have a sight-training exercise. Write two figures on the board, one below the other, let the pupils glance at them, then erase and ask what the numbers were. Work rapidly. Later use three figures.

Use the number cards for a drill on the recognition of number groups.

Have the pupils count to 100, using objects.

Teach the number 11, using a variety of objects to fix the group in the pupils' minds. Have them count 11 children, 11 beads, 11 acorns, etc. Have cards to illustrate various combinations that make 11. Use these in connection with the cards representing 9 and 10, and secure instant recognition of each group.

17. Second Week. Have short but rapid eye-training exercises. Those previously suggested may be repeated with slight variations to keep them interesting to the class.

Let the pupils count as far as they can without objects.

Teach the number 12, using different objects. Show how the number is written. Let the pupils write the numbers through 12.

Introduce the foot ruler. Have measuring exercises with it. Let the children stand, one at a time, against the door, while one of the pupils marks the height of each one. Let the children take turns measuring the heights. Measure the desks, window sills, tables, etc. Let the class work at the board, drawing lines of different lengths.

Teach the term "dozen." Ask what we buy by the dozen. Let the pupils count a dozen acorns, blocks or balls by taking two in each hand as the grocer does. When they are familiar with counting by 2's, try 3's and 4's. (See pages 230, 231.)

18. Third Week. Have a rapid drill in recognizing number groups by using illustrated cards. Domino cards or domino blocks may be used.

Let the pupils construct rugs and borders for wall paper for a doll's house, using rulers for measuring.

Ask how many months in a year. See if any child can give them; if not, teach the names. How many weeks in a month? What seasons have we? How many months in each?

Write and teach the Roman figures to XII.

Continue sense-training exercises.

19. Fourth Week. Use dominoes or illustrated cards to test the pupils' ability to recognize any number group to 13. Teach the pupils to write numbers to 30.

Continue the sense-training exercises.

Introduce the yardstick. Compare it with the foot ruler. Measure the blackboard, the room, the door and the height of the table with the yardstick. Discuss the things we buy by the yard. How many feet in half a yard?

FEBRUARY

20. First Week. Continue sense-training games and exercises. Write the numbers to 30 on the board and let the class copy. The latter part of the week erase these and have the class write them without a copy.

Teach the pupils to tell time, using the hour and half hour.

Have measuring exercises. Let the pupils work at the board and draw squares and oblongs certain sizes as directed. Teach them to place marks on these lines certain distances apart, such as 2, 3 or 4 inches. Have them connect these marks with straight lines, thus dividing the figure into squares. Let them count the squares. Conventional designs may then be developed. Later let the pupils draw squares at their seats and divide them into inch squares. Also make these forms by folding and cutting paper.

21. Second Week. Teach the pupils to use the half-inch marks on the ruler. Let them draw a 5-inch square and divide it into half-inch squares. Then write on the board the numbers to 100 in this manner, and let the pupils copy:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9,
10, 11, 12, 13, 14, 15, 16, 17, 18, 19,
20, 21, 22, 23, 24, 25, 26, 27, 28, 29, etc.

While they look at this chart, let them count to 100 by tens, beginning with 0, and later with any one of the digits.

Towards the end of the week, ask the class to reproduce the numbers from memory.

Begin work with the liquid measures; the pint and quart. Ask what we buy in pints and quarts. Let the class look at the measures and tell how much larger the quart is than the pint; then let them measure sand, bran or water to find out. Let them learn the price we pay for a quart of milk, molasses and vinegar. (See page 255.)

Repeat some of the exercises for training the senses.

22. Third Week. Give the pupils small objects and let them count out twenty of them. Arrange the group in pairs. Count to 20 by 2's. At the close of the lesson let one of the class count to 20 without using the objects.

Begin to teach the combinations that make each number to 12. Begin with 2. Hold up two balls. Ask how many there are. Lay one down and ask what remains. Have someone give the answer thus: "2 less 1 is 1." Take a ball in each hand and bring them together. Ask how many one ball and another ball are. Go to the board, draw two circles and ask how many there are. Then write

$$\begin{array}{r} 1 \\ \underline{1\ } \end{array}$$

and ask the answer. Ask what half of 2 is. Give oral problems involving these facts.

Give sense-training exercises each day.

Give practice in writing numbers.

Have measuring exercises, using the yardstick. Play store, letting the pupils buy and sell goods by the yard and the half yard, the pint and quart.

23. Fourth Week. Have rapid reviews of the number facts learned. Review rapidly the cards used to teach the number groups.

Continue the sense-training exercises.

Teach the combinations that make 3: 1 and 2, 2 and 1, 3 ones; also teach 3 less 1, 3 less 2, 3 less 3. Construct an oblong 6 inches by 2 inches. Divide it into three squares. Teach the meaning of $\frac{1}{3}$. Write it in each square. Let the class discover that $\frac{1}{3}$ of 3 is 1. (See *Arithmetic as Ratio*, page 269.)

Give problems involving the facts concerning 3. Make a new set of number cards to use as the class progresses, using figures in the different combinations which form each number, as:

$$\begin{array}{ccc} 2 & 1 & 1 \\ \underline{1\ } & \underline{2\ } & \underline{1\ } \end{array}$$

Use these for rapid drills each day.

MARCH

24. First Week. Review rapidly all the number facts learned. Have the class count and write numbers to 100. Count by 2's to 50, using objects at first.

Teach the combinations that make 4 and all related facts. Let the pupils fold a square into quarters. Ask how many 2's in 4, what is $\frac{1}{2}$ of 4, $\frac{1}{4}$ of 4. Fill out number cards as follows:

$$\begin{array}{cccc} 1 & 2 & 3 & 1 \\ \underline{3\ } & \underline{2\ } & \underline{1\ } & 1 \end{array}; \quad \begin{array}{cccc} 4 & 4 & 4 & \\ -1 & -2 & -3 & \\ \underline{\ } & \underline{\ } & \underline{\ } & \end{array}; \quad \begin{array}{r} 1 \\ \underline{1\ } \end{array}$$

$\frac{1}{2}$ of 4; $\frac{1}{4}$ of 4.

Have rapid drills on these. Repeat the exercises with the cards

representing the combinations of 2 and 3. Give oral problems involving all the facts learned.

25. Second Week. Give sense-training exercises to keep the pupils alert.

Teach the combinations of 5 and the related facts. Use squares or objects to develop the lesson. Drill carefully on both new and old facts. Ask the class how many cents there are in a nickel. Give oral problems based upon the value of a nickel and the making of small purchases.

By use of objects have the pupils count to 30 by 5's.

Introduce liquid measures.

Review rapidly all combinations learned thus far.

26. Third Week. Teach the combinations of 6, also the related subtraction and multiplication facts. Let the class fold a 6 by 4-inch oblong into 2-inch squares. Develop the fact that 6 contains three 2's, two 3's, six 1's; that $\frac{1}{2}$ of 6 is 3; $\frac{1}{3}$ of 6 is 2; $\frac{1}{6}$ of 6 is 1. Give oral problems involving these facts.

Play store, letting the class use the yard measure and liquid measures. Discuss the change to be given for a quarter, a dime and a nickel in any of the purchases made. (See page 248.)

Review the Roman figures to XII and have exercises in telling time.

27. Fourth Week. Review the combinations taught, also the related subtraction and multiplication facts.

Teach the combinations of 7 and the related facts. Let the pupils draw an oblong 7 by 1 inches and divide it into inch-squares. Let the pupils learn how many 1's in 7; what $\frac{1}{7}$ of 7 is; $\frac{1}{2}$ of 7. Fold the oblong to discover the latter fact. Give oral problems to illustrate these facts.

Continue measuring exercises.

Give practice in telling time.

Lead the pupils to count to 50 by 5's. (See page 231.)

APRIL

28. First Week. Give rapid reviews every day of new or difficult combinations. Drill on them until the pupils recognize each one instantly.

Teach the combinations of 8, also the fractional parts: $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of 8. Give oral problems involving these new facts.

Let the pupils play store to keep in mind the measurements taught and the way change is made. Change for 50 cents and a dollar may be made.

29. Second Week. Give rapid drills on all addition, subtraction, multiplication and division facts taught.

Teach the combinations of 9 and the fractional parts, $\frac{1}{3}$ and $\frac{1}{9}$.

Later, have the class find half of 9 by folding an oblong containing 9 squares.

Give oral problems involving the new facts and also old ones.

Have the class count to 30 by 3's.

30. Third Week. Teach the combinations of 10. Review counting to 100 by 10's. Lead the pupils to count to 100 by 5's.

Give a rapid review each day of the number facts previously taught.

31. Fourth Week. Give oral problems involving the number facts taught; also drills to teach rapid recognition of these combinations. Use many concrete problems.

Teach the pupils to use scales in weighing a pound and a half-pound. Discuss commodities purchased in this way. Play store, using the different measures the pupils are familiar with. If possible have paper money and be careful that each child gets correct change and verifies it. (See page 249.)

Have measuring exercises at the seats, dividing oblongs into smaller oblongs or squares, and squares into smaller squares. Designs for paper or borders may be worked out. The sled suggested in *Construction Work*, Vol. I, page 503, may be made, or the articles suggested on page 510 of the same lesson.

MAY

Note: Many courses of study require that the combinations be taught only as far as 5 plus 5. Others suggest that the work be carried through 6 plus 6. Our plans meet the latter requirement, but each teacher should be guided by her course of study and the ability of her pupils. Many classes should not go beyond the combinations of 10. Very strong classes can sometimes master the 45 primary combinations, but it is best not to crowd children. Teach each step thoroughly and review every day.

32. First Week. Review all combinations that proved difficult for the pupils. Drill on them until the class recognize them instantly.

Teach the combinations of 11. Have the pupils tell how many *tens* in this number. Let them find what half of 11 is by using paper squares. Give oral problems involving the new facts.

33. Second Week. Have rapid oral work either by use of number cards or by writing the combinations rapidly on the board and requiring prompt answers.

Teach the combinations of 12. Have the pupils note the number of *tens* it contains. Teach the fractional parts of 12 by means of pasteboard squares or paper oblongs folded into squares. Give oral problems involving the new facts.

Recall the fact that 12 articles make a dozen. What do we buy in this way. Let the pupils learn the price of common supplies bought by the dozen. Use these facts in playing store. Lead the class to count to 12 by 3's and 4's.

34. Third Week. Drill carefully on all hard combinations, especially those consisting of odd numbers. To prepare the class for future work on the tables, make out the table of 2's as far as the column of six 2's, as suggested on page 239. The tables of 3's and 4's may be made as far as four 3's and three 4's. Drill on these until the class will recognize at once the meaning of any one of the numbers taught.

Review the fractional parts of the numbers taught thus far.

Let the pupils play store. Drill well on the measures.

35. Fourth Week. Give reviews of all addition and subtraction facts to 12. For sight work write a few problems in addition, as:

12	12	10	11	11	10
2	3	3	4	2	5

Give columns of three or four figures whose sum does not exceed 12.

Give reviews in reading and writing numbers.

Continue construction work.

JUNE

36. First and Second Weeks. The aim during the last weeks of school should be to fix well in the pupils' minds all problems in addition and subtraction taught, so that any of these combinations will be instantly recognized. More work in the addition of columns of easy figures should be given to accustom the class to adding quickly and accurately.

If time permits, the class may learn, by folding oblongs or squares into small squares, that $\frac{1}{2}$ is the same as $\frac{2}{4}$ or $\frac{4}{8}$; $\frac{1}{4}$ the same as $\frac{2}{8}$; $\frac{1}{3}$ the same as $\frac{2}{6}$. Drill upon any phases of the work in which the class is weak.

SECOND YEAR

SEPTEMBER

Note: Since little children forget so much during the long vacations, the first five or six weeks should be given to a thorough review of the first year's work.

In connection with these plans, study carefully the work of the second year, pages 258-277.

1. First Week. Give sense-training exercises at the beginning of each number recitation.

Have the children count the boys in each row, the girls, the children in the class, and different objects in the room.

Use illustrated number cards or dominoes for a rapid drill on recognizing numbers.

Let the class go to the board and write the numbers up to 20.

Give construction work requiring simple measurements.

2. Second Week. Continue the sense-training exercises.

Let the pupils count to 50 and write numbers to 50.

Begin a review of the combinations taught during the first year. Give the pupils pegs or other material and let them arrange groups of four in as many ways as possible. Have them describe their work later, as: *2 pegs and 2 pegs are 4 pegs*; *3 pegs and 1 peg are 4 pegs*; *4 ones are 4*. Ask how many 2's in 4, what $\frac{1}{2}$ of 4 is and what $\frac{1}{4}$ of 4 is. Give problems in subtraction and division to illustrate these facts. Have the pupils fold and cut paper to show these facts.

Review the combinations that make 5; also the related subtraction facts. Teach what $\frac{1}{2}$ of 5 is by the use of paper. Give oral problems involving this.

Give rapid reviews by writing the combinations on the board and by using number cards, to keep the number facts well in mind.

3. Third Week. Write quickly on the board the following combinations: (The pupils should give the results at once.)

1	3	2	2	2	4	3
1	1	2	1	3	1	2

Then write the corresponding subtraction facts. If the class hesitate over any, drill carefully on them.

Review the combinations 6 and 7. Give oral problems on these, and drill carefully. If the signs +, − and = have not been taught, make a study of them at this time. Dwell upon the number of 2's, 3's and 1's in 6, also upon the fractional parts.

Give exercises in measuring with the foot rulers.

4. Fourth Week. Give rapid reviews each day on the number work of the previous year. Write columns of 3 and 4 numbers whose sum does not exceed 12. Require quick answers to all of the review work.

Review the combinations of 8 and the related facts in subtraction and division. Count to 8 by 2's. Count and write numbers to 100. Explain the eighth-inch markings on rulers.

Review liquid measures. Play store, using these measures; also the yardstick.

OCTOBER

5. First Week. Give sense-training exercises each day. Continue drills in adding columns of 3 or 4 easy figures.

Review the combinations of 9. Let the class tell what $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{1}{9}$ of 9 are.

Write on the board for rapid drill the following problems:

$$\begin{array}{cccc} 2 & 3 & 2 & 4 \\ 2 & 3 & 2 & 4 \\ & 3 & 2 & \end{array}$$

$\frac{1}{2}$ of 4; $\frac{1}{3}$ of 3; $\frac{1}{2}$ of 6; $\frac{1}{5}$ of 5;

$\frac{1}{3}$ of 6; $\frac{1}{2}$ of 7; $\frac{1}{9}$ of 9; $\frac{1}{2}$ of 5; $\frac{1}{3}$ of 9.

Work these problems out by folding and cutting paper.

Drill on any that the pupils are not familiar with.

6. Second Week. Give rapid drills on all the facts thus far presented. Review the combinations of 10, including the fractional parts. Give oral problems on these. Count by 10's to 100; then by 5's to 100.

Discuss the number of cents in a dime, and the number of dimes in a dollar. Use paper money and let the class make change for articles costing less than a dime, and less than a dollar.

7. Third Week. Have measuring exercises, using foot rules. Squares and oblongs may be drawn and divided into small squares or oblongs. Designs for borders may be worked out with these.

Review the combinations of 11. Write on the board for sight work, such combinations as:

$$\begin{array}{cccccccc} 11 & 11 & 11 & 21 & 21 & 31 & 31 & 41 \\ +2 & +4 & +6 & +2 & +4 & +6 & +5 & +2 \\ \hline 41 & 51 & 11 & 11 & 11 & 21 & 31 & 41 \\ +5 & +2 & -4 & -8 & -2 & -2 & -2 & -2 \end{array}$$

Give also drills on solving "string problems," such as:

$9+2-1$; $7+4-5$; $8+3-4$.

8. Fourth Week. Have frequent drills in addition, subtraction and multiplication. Use dominoes or number cards for drills on the combinations.

Review the combinations of 12 and the related subtraction facts. How many 10's does it contain? What other name have we for 12 articles? What do we buy by the dozen? Count to 12 by 2's, 3's and 4's.

Let the pupils make original problems involving the fractional parts of 12. Give drills on adding columns of figures, whose sum does not exceed 12; then try the following:

$$\begin{array}{cccccc} 12 & 32 & 42 & 12 & 22 & 32 \\ +3 & +3 & +3 & +4 & +4 & +4 \end{array}$$

NOVEMBER

9. First Week. Give sense-training exercises.

Play store to keep the measures and money values well in mind.

Teach the combinations of 13. Teach the related subtraction facts. Let the class find how many 10's in 13; also what $\frac{1}{2}$ of 13 is. Give both concrete and abstract oral problems to illustrate these facts. Mention the 13 stripes in the flag. Give columns of figures; also "string problems," using combinations of 13. Then try the following:

3	13	23	33	43
+4	+4	+4	+4	+4

Teach the class to write numbers to 200. Practice reading these. How many 10's in 200?

10. Second Week. Teach the combinations of 14, the related subtraction facts and the fractional parts, $\frac{1}{2}$ and $\frac{1}{7}$. Give the following oral problems:

4	4	4	4	4	4	4	4
+2	+6	+5	+3	+7	+8	+1	+9

14	14	14	14	14	14
+2	+6	+5	+3	+7	+8

Later substitute 24, 34, 44 and 54 for 14. Have quick answers given.

Continue the work of rapidly adding columns of figures; also give drills each day on all number facts taught thus far.

Teach the reading and writing of numbers to 300. How many 10's in 300?

11. Third Week. Teach the combinations of 15. Teach the related subtraction facts. How many more than 12 is 15? What part of a dozen is 3? 15 represents $1\frac{1}{4}$ dozens. Have the class count to 15 by 3's and 5's. What is $\frac{1}{3}$ of 15? $\frac{1}{5}$ of 15? $\frac{1}{2}$ of 15? How many 10's in 15? How many 5's? 3's?

Give rapid drills on all combinations to 15; also drills on the corresponding subtraction, multiplication and division facts. Develop the tables of 3's and 5's to 15. Give oral concrete problems involving these facts.

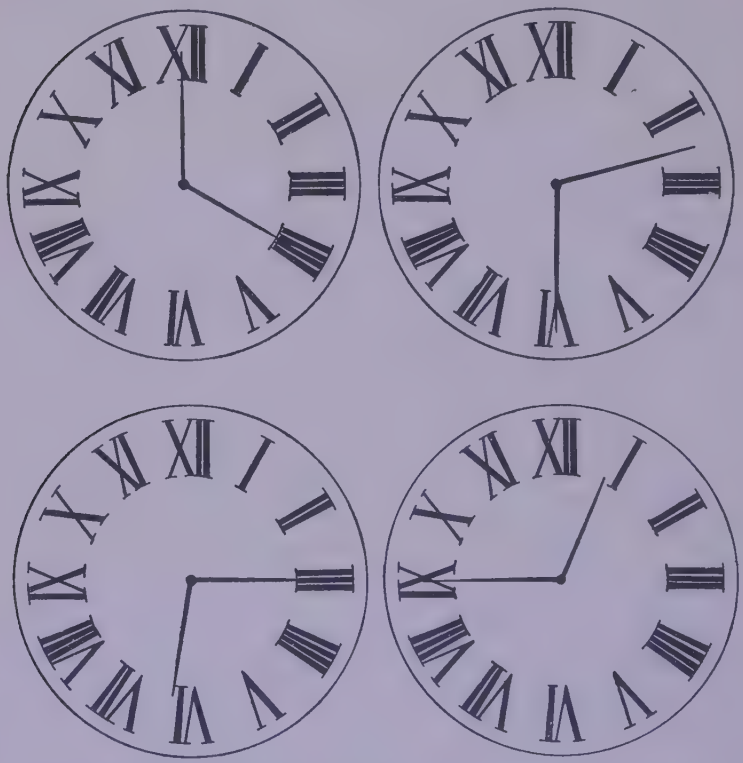
Write the following problems on the board:

5	5	5	5	5	5	5	5
+4	+6	+3	+7	+9	+2	+8	+1

Beneath these write the following:

15	15	15	15	15	15	15	15
+4	+6	+3	+7	+9	+2	+8	+1

Later change the plus sign to minus, *when this will not necessitate borrowing.*



Teach the class to write the Roman figures to XV; also to tell the time, using the quarter hours. A clock dial with movable hands is helpful in exercises of this sort. It costs but a few cents and should form a part of the equipment of every primary school. Drawings like those here given may also be used.

12. Fourth Week. Teach the number 16 in the same way as 15. Show how many 10's in 16, and how many dozen. Teach the number of ounces in a pound. Let the class weigh articles by the ounce. Give oral problems on the combinations of 16.

Review the 2's as far as 12 by using the tabulated form shown on page 239; build the table to 16. Teach the × sign. Teach the pupils to read and write numbers to 500.

DECEMBER

13. First Week. Review rapidly the work on primary addition and subtraction. Review the fractional parts of the numbers which the class have mastered.

Give simple, oral problems to help the pupils to think quickly.

Let the class play store, using paper money and weights and measures.

Have construction work to help fix old number facts well in the pupils' minds.

Teach the addition and subtraction facts of 17.

14. Second Week. Write on the board columns of figures with sums not exceeding 16. Introduce problems in addition with numbers consisting of two figures, but not involving *carrying*, such as:

16	15	25	35
+11	+12	+13	+11

Teach dry measure. Have the pupils play store, using all the measures.

Give construction work.

Teach the number 18. How many 10's in 18? How many 2's? 3's? 6's? 9's? 12's? How many feet in 18 inches? How many dozen in 18 eggs? Teach the fractional parts of 18, and give oral concrete problems involving all these facts.

Combine 8 with various digits for rapid sight work. Change the 8 to 18, then to 28, 38, 48, etc.

15. Third Week. Review the combinations taught.

Teach the addition and subtraction facts concerning 19. How many 10's in it? How many 6's? How many 5's?

Give drills in rapid addition and subtraction. Combine 9 with the various digits, later using 19, 29, 39 and 49 in place of the 9.

JANUARY

16. First Week. Teach the number 20. Have the class learn how many 2's, 4's, 5's, and 10's it contains. Explain that $2\overline{)20}$ means "how many 2's in 20?" Let them give the result, and show them where to write it. Have various pupils go to the board and use the new form in simple problems of division. Let other pupils write the answers to these problems. In giving oral drills, use both forms of expressing division: $2\overline{)20}$ and $\frac{1}{2}$ of 20. Give oral concrete problems involving these facts.

Give problems in addition and subtraction using numbers of two figures which do not require *carrying* or *borrowing*.

Have the class build the table of 2's to 20. Write the Roman figures to XX.

17. Second Week. Have rapid reviews of the primary combinations, and the subtraction facts relating to these. Review the fractional parts of the numbers to 20.

Teach the number 21. How many 10's in 21? How many 3's and 7's in 21? Write the questions thus: 10)21; 3)21; 7)21. Build the tables of 3's to 21. Let the class add columns of figures with sums not exceeding 20.

Teach the reading and writing of numbers from 500 to 1000.

18. Third Week. Review the table of 2's to 20 and the 3's to 21. Give oral, concrete problems to fix these facts in mind.

Review, also, problems in division involving these numbers.

Continue drills in addition.

Teach the number 22. How many 10's in 22? How many 2's? 11's? Give oral, concrete problems involving these facts.

Continue the construction work.

19. Fourth Week. Teach the number 24. Let the class discover how many 10's it contains, also how many 12's. How many dozen in 24? How many 2's, 4's, 6's and 8's in 24? Complete the table of 2's, and build the tables of 3's, 4's 6's and 8's to 24. Give oral concrete problems relating to these facts.

Drill on the reading and writing of numbers to 1000.

Combine 4 with the different digits; then 14, 24, 34 and 44. Write 4)24, 6)24; 2)24; 8)24; 12)24; 3)24. Have a rapid drill on these. Write the fractional parts of 24 and see how quickly the class can give the results.

Give problems like the following:

24	27	65	43	35	125
+25	+31	+22	+24	+42	+131

261	186	489	347	786
+324	+413	−126	−235	−524

FEBRUARY

20. First Week. Teach the number 25. Have the pupils find how many 10's and how many 5's in 25. What is $\frac{1}{2}$ of 25? $\frac{1}{5}$ of 25? What part of a dollar is 25? How many 25's in 100? Build the 5's to 25. To 5 add each digit; then substitute 15, 25, 35, 45 and 55 for 5.

Review each day some of the 45 primary number combinations, and the related multiplication and division facts. Drill especially on the facts hard to keep in mind. Continue such problems in addition and subtraction as suggested in the previous lesson.

Teach the Roman numbers to XXV.

Review the measures by playing store.

21. Second Week. Give rapid drills in adding columns of figures, in giving division facts and fractional parts of numbers.

Teach the pupils to "carry" in addition. Use very simple problems at first, as: $\begin{array}{r} 16 \\ +14 \end{array}$ $\begin{array}{r} 15 \\ +17 \end{array}$ $\begin{array}{r} 25. \\ +18 \end{array}$ Explain the process carefully each day until the class thoroughly understand it. Let them give answers to problems and tell how they get the results. Do not give any written work involving the "carrying" process until certain that the pupils understand it. At first make the problems simple; gradually give more difficult ones.

Teach the number 27. Let the class discover how many 10's it contains; also how many 3's and 9's. Count by 3's to 27. Give oral, concrete problems involving these facts.

22. Third Week. Give drills on the 45 primary addition facts and their related subtraction facts. Give oral, concrete problems involving these.

Continue work in "carrying" in addition.

Practice reading and writing numbers.

Teach the number 28. Find out how many 10's it contains, how many 2's, 4's and 7's. Teach the fractional parts of it. Build the tables of 4's and 7's to 28. Combine 8 with the digits; then 18, 28, 38 and 48.

Drill on the multiplication facts taught thus far.

23. Fourth Week. Give frequent reviews on the work covered.

Teach the facts concerning 30, noting how many 10's it contains, how many 3's, 2's, 5's and 6's. Count to 30 by each of these numbers.

Extend the work in addition until the class can do problems in which two figures must be carried, as:

$$\begin{array}{r} 236 \\ +67 \end{array} \qquad \begin{array}{r} 452 \\ +78 \end{array} \qquad \begin{array}{r} 265 \\ +137 \end{array}$$

Drill on weights and measures.

MARCH

24. First Week. Count by 2's to 50, by 10's and 5's to 100. Give daily drills on all facts that have been difficult for the pupils. Pay special attention to the fractional parts of the numbers between 20 and 30.

Continue work in addition.

Teach the number 32. Note the 10's, 2's, 4's and 8's it contains. Give oral, concrete problems involving these facts.

25. Second Week. Give rapid reviews of the multiplication facts as far as 4×8 or 8×4.

Continue the work in addition.

Review all simple subtraction facts.

Teach subtraction when "borrowing" is involved. Explain this several times in class, and as the pupils grasp it, let them explain it. Then give easy seat work, giving problems in which it is necessary to borrow but once. (See page 264.)

Teach the factors of 35. How many 10's, 5's and 7's in this number? Drill on these facts and give oral, concrete problems involving them.

26. Third Week. Review work in subtraction, then continue it, but do not give problems requiring two "borrowed" figures. Keep the work simple.

Teach the factors of 36. Have the class find how many 10's, 4's, 6's and 9's in it. Count by 2's to 36. Build the tables of 4's, 6's and 9's to 36. Drill on these facts and use them in oral, concrete problems.

Continue the work in addition.

Play store, using paper money. See that correct change is made each time.

27. Fourth Week. Begin each lesson with rapid mental work. Continue the work in subtraction. Teach the class to solve problems in which two figures must be "borrowed," as:

$$\begin{array}{r} 215 \\ -67 \\ \hline \end{array} \qquad \begin{array}{r} 324 \\ -168 \\ \hline \end{array}$$

Teach the factors of 40 and the fractional parts. Give oral problems using these facts. Have the class write the Roman numerals through XL.

Teach the pupils to multiply easy numbers not involving the "carrying" process, as:

$$\begin{array}{r} 24 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 14 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 11 \\ \times 4 \\ \hline \end{array} \quad \begin{array}{r} 42 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 32 \\ \times 3 \\ \hline \end{array} \quad \begin{array}{r} 31 \\ \times 4 \\ \hline \end{array}$$

APRIL

28. First Week. Give rapid drills on the tables as far as the class have gone. Continue simple problems in multiplication.

Teach the factors of 42. Have the class learn by use of objects the number of 10's, 2's, 3's, 6's and 7's in 42, and the fractional parts. Drill on these facts and give oral problems containing them.

29. Second Week. Review the primary addition facts and the multiplication facts taught.

Teach the pupils to "carry" in multiplying. Explain the process as simple problems are worked in class, until the pupils comprehend it, then let them explain the steps. Do not give seat work of this kind until each pupil understands it. (See page 263.)

Teach the factors of 45 in the same manner that other numbers have been taught. Give simple, oral, concrete problems each day.

Continue rapid drills on multiplication facts. Continue work on problems involving the "carrying" of one figure, as:

20	48	35	43
×3	×2	×3	×4

30. Third Week. Give rapid oral work in four fundamental processes. Give written work in addition, subtraction and multiplication. Endeavor to secure rapidity and accuracy. Keep the work simple.

Teach the factors of 48. Let the pupils learn the number of 10's, 2's, 3's, 4's, 6's, 8's and 12's it contains. Count to 48 by each of these numbers. Teach the fractional parts of 48. Complete the table of 4's, 6's and 8's to 48. Drill on these facts.

31. Fourth Week. Continue the work in the fundamental processes, giving special drills on phases in which the class are weak.

Teach the factors of 49. Count by 7's to 49. Drill on the table of 7's.

MAY

32. First Week. Give rapid drills on all the primary facts taught. Give simple, written problems in addition, subtraction and multiplication. Aim to secure rapidity and accuracy.

Teach the factors of 50 and the fractional parts. Teach the Roman numerals to L.

Teach the pupils short division, using even divisions at first. After the previous work in factoring, this should be easy for the pupils.

33. Second Week. Give both oral and written problems in the four fundamental processes. Emphasize the work in which the pupils seem weak.

Review the fractional parts of the numbers learned.

By folding squares and oblongs, impress upon the pupils that $\frac{1}{2}$ is the same as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{6}{12}$; that $\frac{1}{4}$ equals $\frac{2}{8}$ and $\frac{3}{12}$, and that $\frac{1}{3}$ equals $\frac{2}{6}$ and $\frac{4}{12}$. Lead them to add $\frac{1}{4}$ and $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{1}{6}$, $\frac{1}{4}$ and $\frac{1}{8}$, and $\frac{1}{4}$ and $\frac{1}{12}$, by use of the paper squares or oblongs.

34. Third Week. Continue drills on the four fundamental operations.

Teach the class to divide by short division when the division of the first figure does not come out even, as:

$3\overline{)45}$ $\qquad$ $4\overline{)72}$

Continue work in combining simple fractions.

35. Fourth Week. Continue the work in division and simple fractions.

Give simple, oral, concrete problems.

Play store, using weights and measures.

JUNE

36. First and Second Weeks. Use the remainder of the term for work along the lines in which the class are weak. At the close of the year the primary addition facts, the related subtraction facts, the multiplication facts to 50, and corresponding division facts should be so well fixed in the pupils' minds that any one of the facts can be given with no hesitation. Rapidity and accuracy should be secured in all written work.

THIRD YEAR

SEPTEMBER

Note: Each recitation throughout the year should begin with short, rapid drills on some of the primary addition, subtraction, multiplication or division facts. These should become so well fixed in the pupils' minds that they will be able to give them instantly. Study carefully work for the third year, pages 277-285.

1. First Week. Review easy addition facts and the corresponding subtraction facts. Let the pupils give original, concrete problems, involving these.

Give short columns of figures for the pupils to add, and also easy subtraction problems.

Review the reading and writing of numbers.

2. Second Week. Continue the review of primary addition and subtraction facts. Give oral, concrete problems each day to lead the pupils to think.

Review the table of 2's. Let the pupils count to 30 by 2's. Try counting backwards by 2's. Give halves of numbers to 20. Give simple problems in multiplication. Numbers of two figures may be multiplied by 2, 3, 4 and 5.

3. Third Week. Continue the review of primary addition and subtraction facts, and give oral, concrete problems.

Give columns of two place numbers to be added. Review the division facts related to the 2's.

Have measuring exercises, using the foot ruler and yardstick. Let the class construct paper articles, using definite measurements.

4. Fourth Week. Review the table of 3's and the related division facts. Give oral, concrete problems involving these facts. Have the class count to 30 by 3's.

Give examples in short division using 2 and 3 as divisors. Let the divisions at first come out even. Have frequent exercises in addition and subtraction.

OCTOBER

5. First Week. Continue work in addition and subtraction, using numbers of three places.

Review the table of 4's and the related division facts. Count by 4's to 40. Try counting backwards by 4.

Review the table of liquid measure. Give oral problems involving these facts.

6. Second Week. Review the table of 5's and the related division facts. Count by 5's to 100. Give practice in writing numbers to 1000.

Review Roman numerals to L. Have exercises in telling time, as: six minutes after two; seventeen minutes to five. Teach the measures of time.

Introduce easy multiplication problems in which the multipliers are two-place numbers.

7. Third Week. Continue work in the fundamental processes. Give short division problems that do not come out even.

Review the table of 6's as far as 6×8. Count by 6's to 48. Try counting backwards in the same way. Review the related division facts.

Let the pupils read and write numbers to 5000.

8. Fourth Week. Have a measuring exercise. Let the pupils put their forefingers on the end of a foot ruler. Note the distance between them. Lift the fingers, holding them a foot apart. Look at them again. Then send the pupils to the board to draw from memory a line a foot long. Draw another 2 feet long. Get the rulers and test the work.

Draw a line a foot long. Below it draw one half a foot long. Test them. Then try drawing an oblong a foot long and half a foot wide. Exercise care in making the corners. Test these measurements.

Give exercises in easy reductions in the measures of time, as: How many minutes in 120 seconds? How many hours in 360 minutes? How many months in 8 weeks?

Review the table of 7's to 49 and the related division facts. Count by 7's to 49. Let the pupils find the factors of 51. (As a rule, only the numbers involved in the tables are studied, but a knowledge of the factors of all the composite numbers to 100 is an aid in division.)

NOVEMBER

9. First Week. Continue written work in the fundamental processes. Review the tables of 8's to 48 and the related division facts. Give frequent drills upon the fractional parts of numbers to 50. Let the pupils find the factors of 52 and 54. Drill on these new facts. Build the table of 9's to 9×6.

10. Second Week. Review the table of 9's. Count by 9's to 54. Count backwards by 9's. Review the related division facts. Teach the factors of 55 and 56. Drill on these new facts.

Continue the written work in the four fundamental operations.

Have exercises in reading and writing numbers from 1000 to 10,000.

11. Third Week. Let the pupils find the factors of 57 and 58. Drill on these and also on the factors of all numbers from 50 to 60.

Continue the written work in the fundamental operations.

Teach the pupils to write sums of United States Money.

Review measures of time and give problems in simple reductions.

12. Fourth Week. Continue the work of reading and writing sums of money. Let the pupils write these from dictation and add them. Impress upon them the value of the decimal point. See that it is never omitted.

Find the factors of 60 and 62. Teach the Roman numerals to LX.

Review addition of simple fractions, as $\frac{1}{2}$ and $\frac{1}{4}$; $\frac{1}{4}$ and $\frac{1}{8}$; $\frac{1}{3}$ and $\frac{1}{6}$. This should be oral. If the class have forgotten the process, use paper squares, oblongs, or strips to illustrate. Continue rapid oral and written work in all the four processes.

DECEMBER

Note: If the pupils have the primary addition, subtraction and multiplication facts well in mind, the book may be introduced and the work in it followed. At first this work should be taken up slowly, for children must learn to read and understand the problems.

In using the books, the pages containing concrete problems are always difficult for pupils, even though the problems are very simple. This is because the children's reasoning power is only beginning to awaken and they are unable to tell what process to employ in solving the problems. If the teacher will use these for class exercises and work them out with the pupils until the latter part of the year, she will save herself and the class much needless trouble. With a little questioning the pupils will be able to solve the problems easily. Most of the results can be obtained mentally. Hard ones may be worked out on the board after the pupil knows whether he is to add, multiply, subtract or divide.

13. First Week. Continue oral and written work in the fundamental processes.

Teach the factors and fractional parts of 63 and 64. Drill carefully on these new facts, especially on 9×7 and 7×9. Count by 7's and 9's to 63, and by 8's to 64. Drill on the tables of 7's, 8's and 9's as far as 63 and 64. Give oral, concrete problems involving these facts.

Have exercises in reading and writing numbers to 10,000.

14. Second Week. Teach the factors of 65 and 66. Review the factors of all numbers above 50. Count by 11's to 66.

Have exercises in writing United States money, and in adding simple amounts.

Give lessons in adding and subtracting easy fractions.

Have a lesson in measuring. Let the class measure the teacher's desk, the table and the blackboard with a yardstick. Let them give the number of yards. See who can tell how many feet in each measurement. Let them measure objects more than a foot long with the foot ruler and determine the length in inches. Let the objects at first be small so that the pupils will not become confused. They will soon be able to make reductions quickly.

15. Third Week. Teach the factors of 68 and 69.

Let the class write the Roman figures to LXX.

Give drills in multiplication and short division.

JANUARY

16. First Week. Review the factors of all numbers from 50 to 70. Review the tables of 6's, 7's, 8's and 9's as far as the pupils know them. Teach the factors of 70 and 72.

Review liquid measure. Ask the class how many gallons in a certain number of quarts, how many quarts in a certain number of pints. Also reverse the reduction by asking how many quarts in a 2, 4 or 5-gallon jar; how many pints in 2, 3 or 5 quarts. (See page 274.)

Let the pupils make original problems involving the facts of liquid measure.

Give examples in addition and subtraction of United States money.

17. Second Week. Teach the factors of 74 and 75. Review those of 70 and 72.

Have class exercises in adding simple fractions. Let the work increase in difficulty somewhat by giving three simple fractions to be added, as: $\frac{1}{2}+\frac{1}{4}+\frac{1}{12}$. Let the class fold paper strips of the same length to represent halves, fourths and twelfths, if they have trouble in adding the fractions. Compare the fractional parts to see how many twelfths a half will make, and how many a fourth will make. When the class understand this step well, give problems such as these: $\frac{2}{3}+\frac{1}{2}$; $\frac{3}{4}+\frac{1}{2}$; $\frac{5}{6}+\frac{1}{2}$. Keep the work simple. Never give large fractions or those whose common denominator cannot be seen at once. Do not teach the terms of the fraction. Easy subtraction of fractions may follow addition. Do not hurry this work. Give drills on finding fractional parts of numbers.

Give oral, concrete problems introducing easy fractions.

18. Third Week. Review the factors of numbers above 50. Teach the factors of 76 and 77. Have the pupils count by 11's to 77. Let them develop the table of 11's.

Have exercises in comparison of numbers, thus:

Compare 10 with 5.	10 is 2 times 5.
Compare 15 with 3.	15 is 5 times 3.
Compare 6 with 2.	6 is 3 times 2.
Compare 8 with 2.	8 is 4 times 2.

Reverse the comparisons.

Compare 5 with 10.	5 is one-half of 10.
Compare 3 with 15.	3 is one-third of 15.
Compare 4 with 20.	4 is one-fifth of 20.
Compare 2 with 8.	2 is one-fourth of 8.

Continue the work in addition of easy fractions, and of three or four place whole numbers.

19. Fourth Week. Review rapidly the factors of numbers between 20 and 40. Teach those of 78 and 80. Teach the Roman numerals to LXXX.

Continue number comparisons suggested in the previous week's work. After a number of these exercises, give such oral problems as these:

If 2 hats cost $3, what will 4 cost?

If 5 pencils cost 10 cents, what will 15 cost?

If 15 tablets cost 60 cents, what will 5 cost?

If 20 picture postcards cost $1, what will 5 cost?

The class should be able to solve these very quickly after the work in comparisons. A little later they may explain their answers briefly in this way: 15 is 3 times 5. Hence, if 5 pencils cost 10 cents, 15 will cost 3 times as much, or 30 cents.

Give multiplication and short division problems for seat work.

FEBRUARY

20. First Week. Review dry measure. Teach easy reductions in it. Teach the factors of 81. Have the class complete the table of 9's to 99. Drill carefully on these facts. Have the pupils count by 9's to 100. Try counting backwards, by 9's.

Continue oral work in the comparisons of numbers and oral concrete problems based on these comparisons.

Continue addition and subtraction of easy fractions. Give oral, concrete problems containing fractions.

21. Second Week. Give rapid, oral work in finding fractional parts of numbers, thus:

$\frac{1}{2}$ of 8, 12, 24, 36, 10, 42.

$\frac{1}{3}$ of 12, 15, 36, 45, 75.

$\frac{1}{4}$ of 16, 24, 32, 48, 60, 72.

Teach the factors of 82 and 84. Complete the tables of 7's. Count to 84 by 7's. Count backwards by 7's.

Give exercises in ratio and proportion. Draw several pairs of parallel lines on the board. Divide each into feet by short vertical lines. Tell the pupils the divisions on the lines are 1 foot in length. Ask them how long the first one is; the second. Ask them to compare the two. "The first line is half as long as the second, or the second is twice as long as the first." Tell the pupils a new way to express that fact is: "The ratio of the second to the first is 2." Lead them to express the relation of other pairs of lines in the same way. When they grasp the idea, ask them what the ratio of 50 cents to $1 is; of 2 apples to 4 apples; of 3 oranges to 4 oranges. Give short drills in this work each day until it is easy for the pupils to think these relations. (See page 269.)

Have measuring exercises. Let the pupils estimate lengths of different articles, then prove their estimates with a ruler.

Give problems in addition and subtraction.

22. Third Week. Teach the factors of 85. Have rapid reviews of the tables of 7's, 8's and 9's.

Have exercises in reading and writing numbers. Teach the pupils that numbers ending in 0 or 5 are always divisible by 5; those ending in 0 are also divisible by 10 and 2. Numbers ending with an even figure are divisible by 2. If the sum of the digits of a number is divisible by 3, the number is also. Have rapid exercises to fix these facts in the pupils' minds.

Give problems in multiplication and short division.

23. Fourth Week. Teach the factors of 87 and 88.

Give exercises in finding fractional parts of three-place numbers.

Give easy lessons in reduction of denominate numbers. Give concrete problems involving denominate numbers.

MARCH

24. First Week. Teach the factors of 90. Teach the pupils to write the Roman numerals to XC. Review the difficult multiplication facts. Give exercises in finding fractional parts of four-place numbers.

Teach long division, using such problems as:

5)65(4)72(6)84(

Explain the process each day until the class understand it thoroughly. Do not give seat work in long division until certain each child can do the work. (See page 284.)

Then use three-place numbers as dividends and those digits for divisors which will give quotients without a remainder.

Give problems in addition and subtraction.

25. Second Week. Teach the factors of 93 and 94.

Continue the drills on the tables and the work in long division.

26. Third Week. Review the facts of numbers above 80. Teach those of 95 and 96. Complete the table of 8's. Have the pupils give the 12's to 96.

Continue work in multiplication and long division. Give occasional exercises in the reduction of denominate numbers.

27. Fourth Week. Teach the factors of 99.

Continue the work in multiplication and long division.

Begin the use of two-place numbers as divisors, but keep them simple.

Give work in addition and subtraction of easy fractions.

APRIL

28. First Week. Teach the factors of 100. Teach the pupils to write Roman numerals to C.

Continue work in multiplication, long division and easy fractions.

29. Second Week. Give exercises in reading and writing numbers, and in reductions of denominate numbers.

Let the pupils draw a square foot and divide it into square inches. See if they can tell how to find quickly the number of square inches in the larger square. Let them think it out. Discuss the use of square feet. Later have them draw a square yard on the floor and divide it into square feet. Speak of the things we buy by the square yard. Let the class find the number of square inches in book covers, their desks, or other small articles. Let them find the number of square feet in the table, one side of the blackboard, or the floor. Later have them find the number of square yards in these surfaces.

30. Third Week. Review the primary addition and subtraction facts. Continue work in adding and subtracting easy fractions. If the class do this work readily, simple addition and subtraction of mixed numbers may be taught, such as:

$$3\tfrac{1}{2}+6\tfrac{3}{4};\ 4\tfrac{1}{3}+2\tfrac{2}{3}+1\tfrac{1}{3};\ 11\tfrac{1}{2}-5\tfrac{1}{4};\ 15\tfrac{3}{6}-8\tfrac{1}{3}$$

Give exercises in addition and subtraction of whole numbers.

31. Fourth Week. Review the different tables of measure and give easy reductions in each.

Give exercises in comparison of numbers. Follow these by concrete problems as suggested in Section 20.

Give exercises in multiplication and division.

MAY

32. First Week. Review the factors and fractional parts of numbers to 100. Make a list of the prime numbers to 100.

Find fractional parts of three or four-place numbers. Put a list of these on the board and let the pupils tell by observation what digits will divide them evenly.

Continue addition and subtraction of easy mixed numbers.

33. Second Week. Begin a thorough review of the multiplication tables. Drill especially on the difficult combinations. Give concrete problems based on the tables.

Review short division.

Review the square measures taught. Let the class find the number of square inches, square feet or square yards in given surfaces.

34. Third Week. Count to 100 by 2's, 3's, 4's, 5's, 10's, 11's and 12's.

Review problems involving United States money.

Review reading and writing numbers.

35. Fourth Week. Count to 100 by 6's, 7's, 8's and 9's.

Have exercises in estimating the dimensions of articles in the room. Test the estimates. Have the class draw lines of different lengths and oblongs and squares of different sizes from memory. Test the work.

Review Roman numerals.

Give exercises in multiplication and division.

JUNE

The remainder of the term should be devoted to drilling upon the phases of work in which the class are weakest. By the end of the year they should be able to perform rapidly simple problems in all the fundamental operations.

The following review exercises may be used as a test of the pupils' ability at the close of the year:

In 27 pints, there are how many quarts? How many gallons?

In 96 hours there are how many days?

172 ounces are how many pounds?

56 quarts are how many pecks?

How many bushels in 29 pecks?

How many months in 45 weeks?

In 162 feet of tape, how many yards?

In 81 square feet, how many square yards?

Add:

204	109	386	$10.25	$12.45
561	730	209	3.08	7.62
45	58	925	7.92	3.53
378	196	172	5.44	5.97
724	315	338	.67	20.16
496	209	57	24.23	7.08
652	523	155	5.49	73.82
87	82	21	2.25	4.87

Subtract:

561	407	1025	$60.21	$81.06
286	296	786	17.50	15.74

Multiply:

375	427	781	597	936
25	56	47	68	73

Divide:

6)972	5)730	4)5768	7)826	9)7398
21)441	15)470	12)756	25)550	31)651

$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}=?$ $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}=?$ $\frac{2}{5}+\frac{1}{2}=?$ $\frac{1}{6}+\frac{1}{3}=?$ $\frac{1}{2}+\frac{3}{8}=?$

What are the factors of 35, 49, 51, 65, 87 and 96?

Find $\frac{1}{2}$ of 72; $\frac{1}{3}$ of 81; $\frac{3}{4}$ of 56; $\frac{2}{5}$ of 35; $\frac{3}{8}$ of 64; $\frac{1}{3}$ of 726; $\frac{1}{4}$ of 968; $\frac{1}{6}$ of 738.

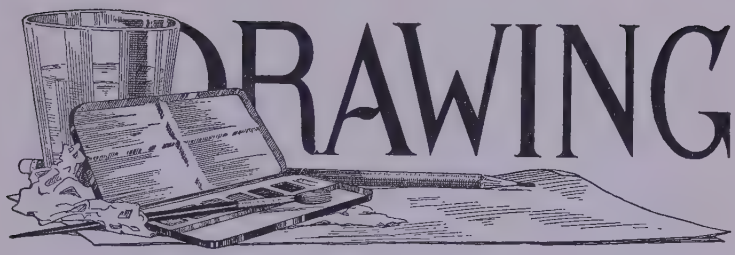
If 3 horses cost $450, what will six cost?

If 2 chairs cost $3.30, what will 6 cost?

If 6 books cost $5.70, what will 2 cost?

If 8 cows cost $600, what will 2 cost?

CHAPTER FOUR



EMELIA M. GOLDSWORTHY

Director of Art, Western State Normal School, Kalamazoo, Mich.

INTRODUCTION

"The things a child can make
May crude and worthless be;
It is his impulse to create
Should gladden thee."

1. Aim of the Lessons. The aim of these lessons in drawing, painting, clay modeling and picture study is to assist in the development of the creative powers of the child; to enlarge his understanding and appreciation of the world of nature; to develop the power to see beauty in commonplace things; to acquaint him with the world of art as expressed in man's handiwork; to increase his respect for the workers of the world in all fields of labor, and to inculcate a desire to become a worker in some field of action, thereby enhancing his joy in living and in contributing to the joy of others. Finally, through a course in public school art it is hoped to improve the environment of the school and home and eventually to bring about a greater interest in civic beauty, thereby increasing the pleasure of living.

At this point we wish to consider briefly the importance of drawing as a means of expression. Long before man had learned the art of writing, crude pictures were used to convey ideas to others, and almost every people have passed through this picture-writing stage. Drawing is, therefore, the oldest means of recording ideas. One who can not with a few strokes of the pencil present an idea in graphic form is at a disadvantage.

Now that vocational training is incorporated into most of the courses of study for the public schools, the value of drawing from the view-point of its practical utility has been strongly emphasized. The craftsman must first create a mental picture of the object he is to make, and if he can sketch this image on paper so as to place it before him in permanent form, he has a practical guide to his work.

Teachers can do much in the way of overcoming the opposition to art work in school that is occasionally found by showing the practical application of drawing to many of the activities in the home, such as drafting patterns, making plans for chicken houses, plotting ground, etc. These features of the work should receive attention in connection with the drawing lessons.

A drawing is the expression of an idea: Art must come from within, and not from without. This fact has led some to assert that the study of nature is not essential to the student, and that careful training in the study of the representation of the actual appearance is mechanical and harmful. Such persons forget that all art ideas and sentiments must be based upon natural objects, and that a person who cannot represent truly what he sees will be entirely unable to express the simplest ideal conceptions so that others may appreciate them. Study of nature is, then, of the first and greatest importance to the art student.— Cross.

2. Arrangement of Plan. The plan outlines the work by months, covering the work of the first to the third grade, inclusive. Specific directions are given for each exercise, but the teacher, to make sure that she can give the lessons without hesitation, and that she can do rapidly and with skill what she asks the pupils to do, should practice the exercises herself as she studies the lesson. Draw every object the pupils are asked to draw; study every subject they

are asked to paint, and make every article called for in connection with the lessons. If you have not had previous experience in this kind of work, you will need to give yourself a good deal of practice on some of the exercises before you can successfully present them to your pupils. This, however, should not discourage you. The exercises are so simple, and the directions so complete, that you are sure to succeed, and in the development of the exercises you will add one more accomplishment to your preparation as a teacher.

3. Materials. The work, to be carried out most effectively, is dependent upon the selection and proper use of a number of nature and art materials. The nature materials will be considered under the outline for each week's work. The art materials consist of paper, pencils, crayons, outfit for water color work, rulers, paste, scissors and clay.

(a) PAPER. The paper used for work in drawing and painting is an inexpensive manila, cut any size, but usually sold in two sizes, 6x9 and 9x12 inches. Cream-tinted paper is preferred to white paper, as the white paper is not an agreeable tone for water color effects, and the use of the slightly cream-toned paper is much easier on the eyes; besides, it is very much less expensive. Colored paper for mounting, construction and cutting work should include a large range of colors, including red, orange, yellow, green, blue, violet, gray, brown and black.

A light weight of cardboard should be available for simple problems in cardboard modeling or construction work.

Large cardboard sheets, 22x28 inches, of neutral gray tone, for use in mounting school exhibits, should be included in a list of supplies.

(b) PENCILS. A soft pencil is necessary for use in free-hand drawing; SS grade is a very good one. Any of the standard pencil manufacturers make good pencils — Dixon, Eagle or Prang.

Care of Pencils. The pencil should be sharpened to a blunt point and rubbed down on paper to make the best point for drawing. The drawing pencils should not be

used for writing, but kept in cases made for the purpose, or kept by the children in their desks, in cases made for the purpose of holding all their art materials. If pencils are kept by the teacher, each pencil should be marked with the owner's name, and should always be used by the owner alone, for sanitary reasons.

(c) Crayons. Colored crayons have become almost as universal a medium as the pencil, and, in the absence of water color, a substitute for that medium. If but one medium could be obtained, a box of colored crayons would be recommended as the best medium to purchase. A box containing eight colors—red, orange, yellow, green, blue and violet, brown and black—is manufactured by several reliable firms whose addresses are given under the heading *Supplies and Supply Houses*, Section 4.

(d) Water Colors. The use of color in connection with art study is indispensable. Surrounded by a world of beauty in color, one can only inadequately express form without the use of color. The three-color box, containing red, yellow and blue, with black added, is the most acceptable box of water colors for school use. The colors may be purchased separately at three cents per cake. For prices of boxes, consult the catalogues of any of the firms named in Section 4.

(e) Brushes. A No. 3 sable brush, costing seven cents, has been found the most practical for general use in school work. A Japanese brush, costing five cents, for line work is very convenient, but the sable can be substituted.

(f) Water Color Pan. This may be purchased at small expense. It is a small, black, japanned tin, with enamel lining. Tops of tin cans or fruit jars may be made to serve as substitutes.

(g) General Care of Materials. Most of the materials needed in the art lessons can be cared for by the individual pupils by placing everything belonging to one child in his desk in a box; or, a cloth case may be made especially for this purpose. Materials furnished by the school, such as paper, should be passed out at each lesson.

4. Supplies and Supply Houses. The art materials enumerated, as well as many others, including drawing textbooks for pupils' use and teachers' manuals, may be obtained at the following supply houses: The Prang Co., 6 N. Michigan Ave., Chicago; D. C. Heath & Co., 1815 Prairie Ave., Chicago; Scott, Foresman & Co., 633 S. Wabash Ave., Chicago; Atkinson-Mentzer Co., 2210 S. Park Ave., Chicago; Joseph Dixon Crucible Co., 53 W. Jackson Boulevard, Chicago; Milton Bradley & Co., Springfield, Mass; Devoe & Raynolds Co., 14 W. Lake St., Chicago; and the Thomas Charles Co., 207 N. Michigan Ave., Chicago.

SEPTEMBER

The goldenrod is yellow;
The corn is turning brown;
The trees in apple orchards
With fruit are bending down.

The gentian's bluest fringes
Are curling in the sun;
In dusty pods the milkweed
Its hidden silk has spun.

The sedges flaunt their harvest
In every meadow nook,
And asters by the wayside
Make asters in the brook.

From dewy lanes at morning,
The grapes' sweet odors rise:
At noon the roads all flutter
With yellow butterflies.

By all these lovely tokens
September days are here,
With summer's best of weather,
And autumn's best of cheer.

—Helen Hunt Jackson.

5. First Week. (a) Decorating the Schoolroom. This beautiful poem enumerates some of the interesting nature subjects that will be available for use in the art lessons during the month. During the first days at school encourage the children to bring in some of the pretty grasses, weeds and flowers they may find on their way to school, or on their nature trips to some vacant lot or near-by woods. By all means, decorate the schoolroom with some of these trophies. Have some of the children bring from home earthen or glass fruit jars, in which to place the bouquets. Do not arrange several kinds of flowers together, but make a bouquet of one kind; sometimes two varieties will make a pleasing effect. Try to provide a bouquet of flowers or grasses for the teacher's desk while the autumn flowers last.

Cautions. (1) Avoid having bouquets of nature material around when they begin to show signs of decay.

(2) Great care should be shown in changing the water frequently; some of the grasses, weeds and seed pods collected do not need water, but may be allowed to dry, as they can be kept during the winter months.

(b) Lessons in Color. Conversational lessons on the colors found in the different flowers will prepare for lessons in expression later. The teacher should be provided with a color chart of the six colors, normal red, orange, yellow, green, blue and violet. These charts may be purchased or made of colored paper by the teacher. Arrange the colors in the order named. It is a good plan to write the color names on the blackboard, with the appropriate color crayon, and to draw a flower or fruit, or even a colored circle beside the word, to associate color impressions with the name of the color. The teacher should be provided with a glass prism, and she should allow the children to see the beautiful rainbow colors which a ray of sunlight produces.

Draw on the board a bow of the six colors to represent the rainbow. Ask the children if they know how the colors are arranged in the beautiful arch in the sky that sometimes

comes after the rain. The red is on the outer line, and the other colors follow in the order named above.

Read to the children the Indian legend in *Hiawatha* regarding the rainbow:

> Saw the rainbow in the heaven,
> In the eastern sky, the rainbow,
> Whispered, "What is that, Nokomis?"
> And the good Nokomis answered.
> "'Tis the heaven of flowers you see there;
> All the wild-flowers of the forest,
> All the lilies of the prairie,
> When on earth they fade and perish,
> Blossom in that heaven above us."

(c) Use of Water Colors. Explain to the children, as scientifically as possible, why the bow of colors appears after the rain. There are three colors in the pigments we use, from which all the other colors are made. These three colors are red, yellow and blue. Have the children then take their boxes of water colors and make some of the colors they see in the rainbow.

Material. A box of water colors, a small pan half filled with water, a brush, a piece of soft cloth to clean the brush, and two pieces of manila paper 6x9 inches.

Method. Moisten the colors by touching them with the brush wet in the water. Ask the pupils what colors they see in the sky, and have them try to make a light blue in their boxes. Put a few brushfuls of water in one division of the cover of the box, which is to be a palette for making or mixing colors, and then rub lightly across the blue cake and mix this color in this water, making a light blue wash. Then put a light blue wash all over the paper, to represent the sky. Fill the brush full of the light blue color, commencing in the upper left corner and painting a strip across the top of the paper. Fill the brush again and continue a second strip below the first one; repeat this process until the paper is covered evenly. Continue the study, asking questions such as the following: "Would you like to make a color for the grass-covered ground? What color is it? How

shall we make green?" Direct the children to mix some yellow with the blue wash in the box, and watch it turn to green. If the wash is too light, add more blue. If it should become too dark, use more yellow and water.

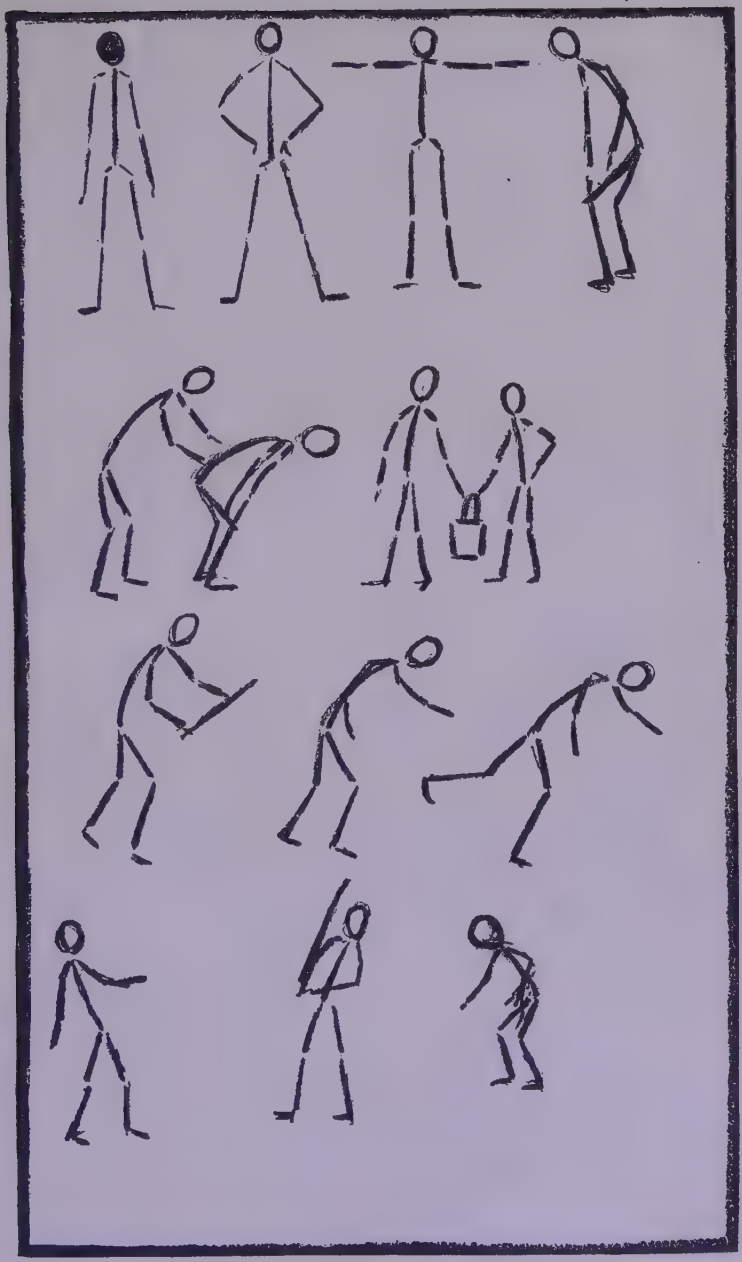
Commence to put the green wash on, to represent the ground at the lower edge of the paper, and with light sweeps of the brush filled with the green wash cover the lower part of the paper to represent the grass. Allow the children to divide the space as they choose, having more sky than ground space, or *vice versa*. An irregular division of the space is more pleasing than an even division. This will be sufficient for the first lesson, if the children have not used water colors before.

Follow this lesson with an attempt to represent the distant trees along the horizon line, with a darker green than the grass. Let the brush dance along the edge where the ground and sky meet, to show the mass of the woods in the distance.

This lesson may be varied by asking the children in the second grade to represent the clouds in the sky by leaving the paper bare in spaces where the clouds show.

In the third grade a sunset sky could be represented; or, a road or stream running through the meadow would vary the simple picture.

6. Second Week. (a) FREE ILLUSTRATION. To test the children's power to recall and represent some interesting scene, use as the subject for a free illustrative lesson, *What I Did During Vacation*. Interest the children by such questions as the following: "Were you on the river or lake in a boat? If so, can you make a picture of the boat? Was it a rowboat, a sail boat or a steamer? Did you fish or go wading, or dig in the sand? Draw a picture to show me what you used to play with or how you looked while playing. Perhaps you were on the farm and were having a good time feeding the chickens, gathering the eggs, playing on the hay stacks, or riding in the big wagon and helping to drive. Show me by a drawing some of the pleasant times you had.



FIGURES EXPRESSED BY STRAIGHT LINES

If you were helping mother wash, iron, sweep, bake or care for the baby, you can make a picture of a little girl at work; or, if any of the boys were helping mother or father, tell me with your crayon just what you were doing. What fun to make a picture of ourselves, showing how we looked at work or at play!"

Material. Use manila paper, large size, 9x12 inches, and colored crayons, for the work in free illustration.

Method. After the children have expressed themselves as well as possible, tell them that you will help them in the next lesson to make a picture showing a little girl or boy playing.

(b) Figure Drawing. *Material.* Manila paper and black crayon.

Method. Choose a little boy and ask him to come and stand perfectly upright, with arms close to the body. Direct the children to make one line on the paper to represent what the boy is doing—standing. Give them another name for the position—*vertical*, meaning upright—and explain that the line is said to be in a vertical position. Draw a line to represent the boy lying down, and explain that this is called a *horizontal* position. Show them how to represent the trunk with one straight line, the limbs, both upper and lower, with two lines each, and the head with a little circle. Draw on the blackboard to illustrate the standing figure, using skeleton lines, as shown in the illustration. Ask the little boy to run across the schoolroom. Call the attention of the children to the slanting position of the body and limbs, and represent this on the blackboard as shown in the illustration. Ask the children to illustrate, without help, a figure with arms extended; another figure with arms akimbo; another holding a bat; another holding a fish pole, etc. After the children can express action with the skeleton figure, show them how to fill in and clothe the figure. By using the side of the crayon they can make a silhouette figure, as shown in the illustration on page opposite.

After several drawings have been made showing various positions of the boy in action, choose a little girl and pro-

FIGURE PAINTING IN WATER COLOR OR INK WORK

ceed in the same way, making the skeleton lines first, then adding the clothing. Imagine the little girl running, jumping a rope, rolling a hoop, etc. The colored crayons would be attractive to use in these studies, as they give opportunity to show the color of the dress or hat. Suggest using one other color with black, so that a medley of colors may not be used on one figure.

Continue figure drawing in the next lesson, illustrating on the blackboard for the children the addition of a landscape with the figure, to show an outdoor setting. Draw a horizon line and represent trees in the distance, as shown in the previous lesson. Colored crayons may be used, and the color of the sky, ground and trees may be massed in as in the water color study suggested.

7. Third Week. (a) STUDY OF GRASSES. Have the children give the names of some of the grasses gathered recently; as the foxtail, millet, squirrel-tail, barley, timothy, rye, oats, etc. Let them choose one and place it on a cardboard easel, standing the grass upright, just as it grows. Pin it in place against a long, narrow piece of paper, placed on the piece of cardboard bent to stand like an easel. First have the children fold the paper along the center, making a panel shape in which to draw the picture. Ask the children to draw a long line to represent the graceful stem, and call their attention to the delicacy of it. Have them add the grass head, or ear, as it is called, noticing how wide it is and how long, also how fuzzy the edge appears. Use the crayon, making strokes close together to represent the grass head. See illustration of grasses. After two or three grasses have been drawn on paper, let some of the children try drawing on the blackboard, others making memory drawings on paper at their seats.

(b) MEMORY DRAWINGS. Memory drawings for seat work make very valuable lessons.

8. Fourth Week. (a) FLOWER PAINTING. *Material.* Secure a large, simple flower, such as the sunflower, field lily, cosmos, clematis, aster or golden-rod; the flower may

GRASS STUDIES IN PENCIL, CRAYON OR BRUSH WORK

be chosen with reference to the children's power of execution. A water color outfit and manila paper will be needed for this work.

Method. Have a conversation lesson first, always, to impress the color and form of the flower, stems and leaves upon the child's mind. Children form impressions quickly and very often express these impressions without referring again to the object.

The teacher should make a picture before the children that they may acquire good habits of work. Place your paper where all the pupils may see you work. Show them how you moisten the color you wish to use, how to take the moist color from the cake, or how to mix the colors slightly in the palette, if the color to be used is not a primary color. The sunflower and field lily will be made by mixing a little red with the yellow, as will also the golden-rod, while the clematis and aster may have a little blue and red mixed together to match the color. Paint the flower, putting on the lightest or brightest color first; for instance, in the sunflower or cosmos put in the petals before the centers. After painting the flower, paint in the stem and leaves, and show the shape, size and arrangement of the leaves. Paint in mass, working from the center out to the edge, and try to paint the leaf with one stroke of the brush. If this is not possible, add one stroke beside another until the size and shape of the leaf are secured. To obtain the right tone of green, try adding a touch of red with the yellow and blue to make it less brilliant and grayer in tone.

Caution. Do not outline the form with either pencil or brush and fill in, but paint in directly.

Continue flower painting, using the nasturtium, red flowering sage, or other garden flower, in the second and third grades, if the children have had work along this line in previous years. The children will enjoy trying the same flower many times, until they can do the work easily.

(b) Memory Lessons. A lesson without the object is one of the most valuable means for impressing the form and color on the child's mind.

(c) Exhibits. It is hoped that the teacher has provided some means whereby an exhibit of the children's work may be placed before them. Occasionally a whole class lesson should be exhibited, and criticisms should be made, in which the children may express their opinions of the work.

A string fastened about five inches above the chalk trough, crossing the board, would be one means of holding the drawings in place when a class exhibition is being made. A wall space covered with burlap makes a most desirable background against which the drawings may be pinned.

A permanent exhibit could be mounted on the gray cards and fastened together with twine, through holes punched equally distant from the corners. The row of mounts could then be suspended from the picture moulding.

There is nothing that so stimulates the interest of the children as to see their work in comparison with that of their classmates. Besides this, some good examples of drawings and paintings which the teacher makes could be mounted and placed where the children's eyes may occasionally rest upon them and unconsciously absorb as valuable lessons as those obtained during the class period. The lessons gained during this period of the child's development are largely through imitation, hence the value of having good examples of work always before the children.

Test. Illustrate the figure in various actions by drawing the skeleton lines which represent it.

Make from nature two studies of grasses in silhouette, using black water colors or ink.

Write a brief outline of work done in drawing during September.

OCTOBER

One mass of sunshine glows the beech;
Great oaks, in scarlet drapery, reach
Across the crimson blackberry vine
Toward purple ash and sombre pine.

The orange tinted sassafras
With quaintest foliage strews the grass;
Witch-hazel shakes her gold curls out
'Mid the red maple's flying rout.

Our forest that so lately stood
Like any green, familiar wood,
Aladdin's fabulous tale repeat;
The trees drop jewels at our feet.

With every day some splendor strange,
With every hour some subtle change
Of our plain world; how could we guess
Such miracles of loveliness.

LUCY LARCOM.

9. Nature Walks. During your nature walks in the beautiful month of October, call the children's attention to the wonderful changes going on in the colors in the foliage. Ask them to tell what is the color scheme of the maple, oak, sassafras and willow; which trees assume the autumn coloring first; which tree is called the "king of colonists"; which trees drop their leaves early, and which hold them late.

Besides collecting the various leaves, study also the seed pods, nature's treasure caskets. The milkweed, jimson or Jamestown weed, Indian mallow, cat-tail and teasel will make beautiful winter bouquets, besides furnishing interesting material for nature and art study. The fruits, and nuts, too, serve as rich harvests to the nature and art lover as they do to the farmer.

10. First Week. (a) AUTUMN WEEDS. Choose one of the pretty weeds, milkweed with seed pods, or teasel, and study it carefully. Introduce the study in this manner: "What kinds of seeds has this plant? Some seeds are provided with wings to help them fly and scatter about; some have stickers that fasten themselves to clothing; others merely drop from the pods to the ground below. Which kind has the milkweed? the teasel? the Indian mallow? Study the shape and color of the pod and how it attaches it-

STUDIES OF SEED PODS, IN WATER COLOR OR INK

self to the stem. Do you think you could show with your crayon the color and form of the branch studied?"

Place a branch where all may obtain a good view, and after questions concerning the size of the stem, arrangement of the leaves or pods, whether growing opposite, alternate, singly or in clusters, let the children draw with crayon a picture of the branch.

Continue the study of seed branches during the week, and vary the lessons by using different materials or a different medium, as, for instance, a lesson in water color work could follow a lesson in colored crayon. A silhouette study in black water color or ink would make a pleasing variety. See the illustration.

(b) SEAT WORK. Freehand cutting of the seed pods would be a very valuable review lesson of the form side of the study, as the scissors is a very necessary tool to learn to use.

11. Second Week. (a) AUTUMN LEAVES. Choose some of the pretty, gayly colored leaves, and make a collection, pressing and mounting the different varieties. Urge the children to strive for the largest collection possible, then bind them together and make little booklets of the leaves. While the children in the first grade press and mount specimens, the second grade could paint their collection, using the single leaf, and the third grade could make a study of two leaves on a branch. See Color Plate, Maple Leaves.

In the first grade the leaves may be traced around, in the first studies, and then painted with water colors; the children in the second and third grades can paint the leaves without tracing or outlining, painting them in mass, dropping in the bright colors as the color of the leaf suggests. If the single leaf is used, let each child be provided with one on his desk; but if a small branch is used, the teacher should pin the studies on the pasteboard easels and place them where the pupils may easily see them.

A good device for placing such small studies is to have thin, light-weight boards placed between the front desks in

THE MAPLE

Plate One

MAPLE LEAVES

TREE STUDIES, IN WATER COLOR OR INK

every other aisle and half way back in the row, so that children in the back seats may see the studies equally well. This allows every other aisle free for the teacher to pass back and forth to give individual criticisms.

Make as many leaf studies as you can during the week. The water color or colored crayons will be the best mediums to use.

(b) Book Cover. Tell the children that they may now plan a cover for the leaf booklets. Use the brown or gray paper for a cover. It is difficult to obtain colored paper, so use some of the heavy wrapping paper which may be obtained at the stores. Use a leaf form for a unit, and make a border across the book cover. The leaf units may be cut out and pasted in a row to form a border, making a good first grade problem; or, after a unit has been cut it may be traced on the cover to make a border arrangement, and painted in a flat color or in black, making a silhouette effect. Border lines above and below the units should always be added to complete the border effect. See the illustration, page 353.

12. Third Week. (a) Trees. When the trees are the gayest in color is the time to try to express the October landscape. Choose some tree, one that you have had an opportunity to study and enjoy, and after the children have observed the color scheme, the laws of growth in branching, etc., ask them to try to make a picture of this tree in water color. If it is the maple tree, and the yellow and orange colors predominate, mass in with a brushful of color the general effect of the foliage with the lighter color (yellow), and then drop in the red to make the orange hues; or perhaps some leaves are still green; if so, paint the green by taking the colors fresh from the cakes and allow them to blend on the picture instead of mixing the colors in the box. This gives the fresh effect that one is apt to lose if the colors are mixed together too much. If the oak is chosen, then the rich browns may be obtained by mixing all these colors—red, yellow and blue—together, and if the brown has a reddish tinge, use more red than yellow and blue.

Plate Two

AN OCTOBER LANDSCAPE

Plate Three

THE PUMPKIN

Cautions. (1) Do not use black under any circumstances to make a color darker, for it makes the color dull and muddy. By using more of the blue and red you can darken any color.

(2) Do not use much water where the color required is very dark, as in the trunks of the trees.

(b) Landscapes. After a lesson on the separate tree on yellow paper, continue the October landscape by painting the sky a blue and the ground a brown, to suggest the brown grasses or fallen leaves. After the sky and ground are nearly dry, paint the large tree in the foreground of the picture. See illustration. Proceed in the same manner as you did in representing the tree alone on the dry paper.

The woods in mass, represented in the distance, would be a good review, following the suggestion given for painting a landscape in September.

(c) Illustrating a Poem. Read to the children a few lines of poetry descriptive of the October landscape, and let them represent it as they recall seeing the woods. Following is an appropriate stanza:

Now, like Aladdin of the days of old,
  October robes the weeds in purple gowns;
He sprinkles all the sterile fields with gold,
  And all the rustic trees wear royal crowns.

The straggling fences all are interlaced
  With pink and purple morning-glory blooms;
The starry asters glorify the waste,
  While grasses stand on guard with pikes and plumes.

13. Fourth Week. (a) Fruits. Choose some of the fall fruits for representation—the pumpkin for the first grade, the apple or pear on the branch for the second and third grades. If the pumpkin is chosen, the teacher can weave around it the Hallowe'en sports and games. After painting it in water color, working in mass and representing the deep creases in its surface by using a little blue with the red and yellow colors to make a shadow color, the children would enjoy cutting the pumpkin to represent the jack-o'-

lantern. Then a lesson might follow where the picture is represented with the grotesque features of a face.

Use the large size paper, and make large paintings. These may be cut out and a row of jack-o'lanterns may be fastened at the edge of the board. You can represent some of these faces as being mirthful by making the up-turned lines in the features, and the opposite effect by drawing the lines downward.

(b) Modeling. A lesson in clay modeling would be very appropriate in connection with the study of the pumpkin, apple or pear. After the clay has been softened to the consistency of putty, by placing in a bag immersed in water, let the children each take a piece about the size of a two-inch ball, and try to form the object they are studying. Model it with a little tablet underneath, so that the object will have a base and will not roll about without a proper setting. See halftone illustrations opposite.

If the fruit on the branch is chosen for a lesson, the first work might be done in gray tones to get the form of the study, using black water color and water. Following this, make a study of the object in full colors, leaving a high light of light blue, if the surface of the fruit is shiny.

In modeling the fruit, the apple or pear may be modeled in the full round, or in relief against a clay tablet, showing the branch and a couple of leaves in low relief.

Too much cannot be said in favor of the use of clay in representing objects in the three dimensions, as no other medium compares with this one as a means of expression. After a little practice in preparing the clay, the teacher will not find it troublesome; after it has once been softened it can be placed in an earthenware jar and kept moist for some time. After the lesson some of the specimens may be saved, and the remainder should be pressed together to form a cake, and then pounded together to make a smooth mass. The janitors are usually willing to assist the teacher in the first preparation of the clay, which consists of pounding the lumps small and soaking in a coarse bag for a day or two.

Photograph from Western State Normal School, Kalamazoo, Mich.

CLAY MODELING

Then suspend the bag and allow the water to drain off. After rolling the clay into a cake and placing it in a dry cloth, it will be ready for use. Use a string to cut the clay in small pieces for class work. Place a piece of paper under the clay on the desk. Do not roll the clay in the hands, but press it into shape with the thumb and fingers. No other tools are necessary for this work.[1]

Read to the children the first stanza of the poem which follows; the teacher will appreciate the second stanza:

I took a piece of plastic clay
And idly fashioned it one day;
And as my fingers pressed it, still
It moved and yielded to my will.
I came again when days were past;
The bit of clay was hard at last;
The form I gave it still it bore,
But I could change that form no more.

I took a piece of living clay
And gently formed it day by day,
And moulded, with my power and art
A young child's soft and yielding heart.
I came again, when years were gone—
It was a man I looked upon.
He still that early impress bore,
And I could change it nevermore.

Test. Make a study from nature of a seed pod on the branch, using colored crayons.

Paint a simple October landscape representing a maple tree, or an oak tree, doing the work from nature.

Write a brief outline of work done in drawing during October.

NOVEMBER

November woods are bare and still;
November days are clear and bright;
Each noon burns up the morning chill;
The morning's snow is gone by night;

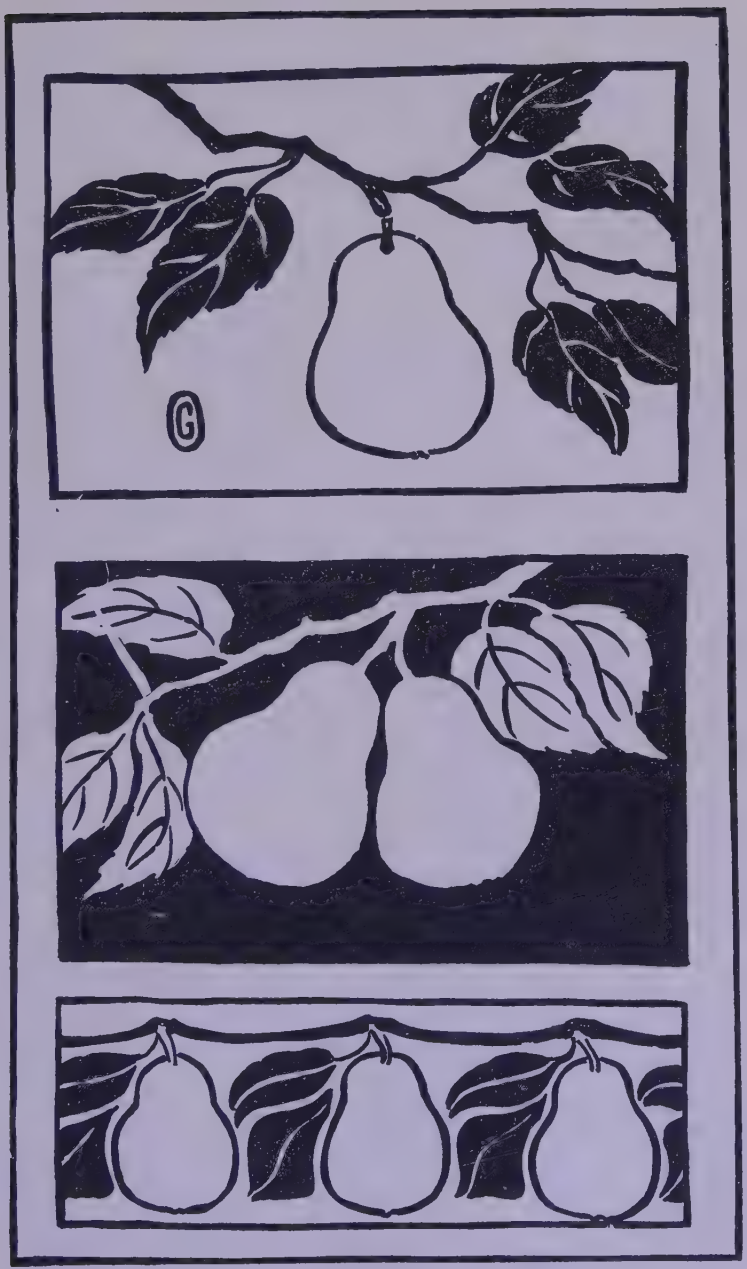
[1] If near a brick, tile or pottery works, ground clay can be obtained at slight cost. Clay may be obtained at one cent a pound from the Star Stoneware Co., Crooksville, Ohio.

Each day my steps grow slow, grow light,
As through the woods I reverent creep
Watching all things lie "down to sleep".
HELEN HUNT JACKSON.

14. Preparatory Work. The interests of November center around the preparations made for winter, both by man and the lower animals. The children will be interested to tell you of the household stores in fruits and fuel that the kind and thoughtful mother and father are storing away. The farm products are loaded into wagons and brought into the city, or stored in the granaries for future use. How dependent all are on the farmers' successful harvest! How grateful we should be for his services in providing us with our daily food. Ask the children if they have ever lived in the country or visited on the farm when the harvest was being gathered. Ask them to name the fruits, vegetables and grains that come from the farm. Have them name the varieties of potatoes, squash, beets, parsnips, onions, carrots, turnips, etc., also varieties of apples, pears, peaches, and the grains —corn, wheat, rye, barley and oats—also the nuts—hickory, walnut, butternut, chestnut, beechnuts. Suggest a nutting party for a day's outing in the woods some Saturday. Many trophies could be brought back to use in beautifying the schoolroom and also afford interesting subject-matter for nature study, art study and composition work. To describe and illustrate some incidents of a nutting party would vitalize both the oral and written work, and would awaken the perceptions of even the dullest pupil. Try it.

Have the children describe the preparations the animals make for winter—the squirrel, gopher, hare, field mouse, bear, etc., also the insect world. Let the children collect and bring to school the largest possible variety of nature's fruits.

15. First Week. (a) FRUITS AND VEGETABLES. Suggest to the children that they make pictures of some of the fruits and vegetables that are most attractive in form and color. The Hubbard and the crook-necked squash, the turnip,



STUDY OF FRUIT BRANCH, IN BLACK WATER COLOR OR INK—DESIGN FROM FRUIT BRANCH

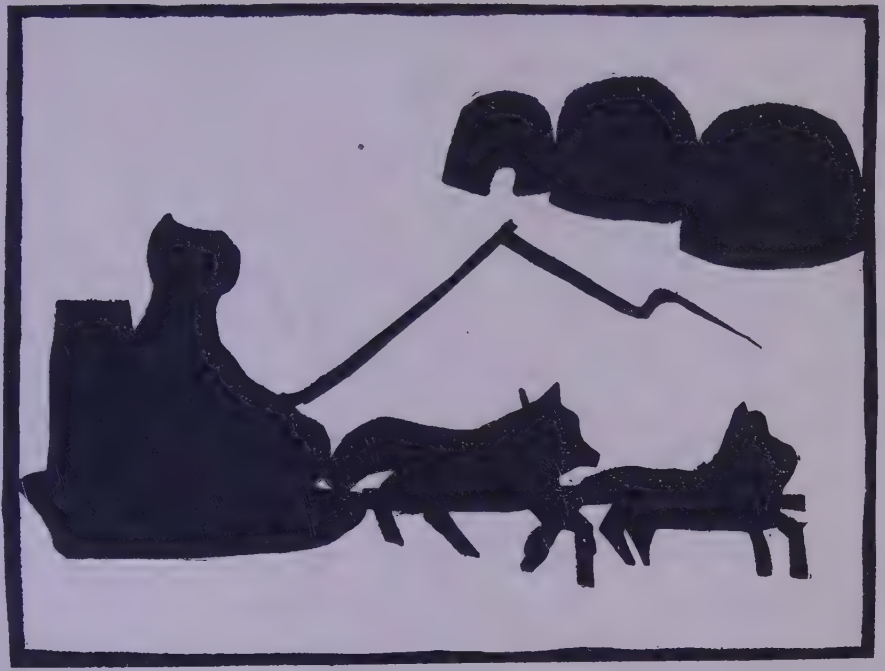
beet and onion, all make attractive studies. Draw in crayon, or paint in silhouette or in full color. See illustrations. The large variety of subjects makes it possible to choose different ones for each grade. The larger ones are best suited to the lowest grades. Place them on a chair, which may be placed on the teacher's desk, in plain view of all pupils. If the smaller vegetables are chosen, place them on boards between the front desks.

(b) Cutting and Modeling. Freehand cutting, or tearing the paper to represent the rough surface of the squash, would make good seat work. If the sand table is used to carry out the idea of the farm activities, the barns, wagons and wheelbarrow could be folded from bogus or wrapping paper, or thin wood could be used and the children given the opportunity to use the saw, hammer and tacks to fasten the parts together. Clay could be used to fashion the animals of the farm—horses, cows, sheep, pigs—or the children could bring their toys from home. This problem may occupy the greater part of the month, the children being happy to work at the sand table before and after school hours.

16. Second Week. (a) Outdoor Studies. Compare the general aspect of the outdoor world this month with gayly-robed October. Ask the children if they can recognize the trees after the leaves are gone. Call to mind the general features of the landscape by such questions as the following: "Have you noticed the beautiful effects of the bare trees against the sunset skies? What colors are in the sky at sunset time? Could you paint some bright skies during one lesson and the next lesson add the bare trees with your black crayon?"

Choose different trees in the different grades. Try representing the frisky squirrel on a tree branch, or at the base of the trees. Make a large picture of the squirrel with its bushy tail. See illustration, page 381.

(b) Illustrate Reading Lessons. Continue free illustrations of the stories brought out in the reading lesson or morning talks.



THE STORY OF LITTLE AGOONACK AS TOLD BY A CHILD IN THE FIRST GRADE —

ILLUSTRATING THE USE OF FREE HAND CUTTING.

MATERIALS BLACK PAPER AND SCISSORS

17. Third Week. Special Events. Illustrate stories connected with the boyhood of Hiawatha, also stories connected with the first Thanksgiving. Make a wigwam of sticks and skins, and decorate it with Indian symbols. If possible, let the children make the Indian shirt and decorate it with symbols or picture writing, using crayola or water colors. They can also make the Indian headdress and will enjoy the work.

If the first grade has chosen the working out of farm life on the sand table, the second grade could develop Indian life, and the third grade might take up colonial life and build the first log house and make Priscilla caps and kerchiefs to wear at the Thanksgiving festival. Let the work be in preparation for the national holiday, and try to cultivate the true spirit of Thanksgiving.

18. Fourth Week. Preparation for Thanksgiving.

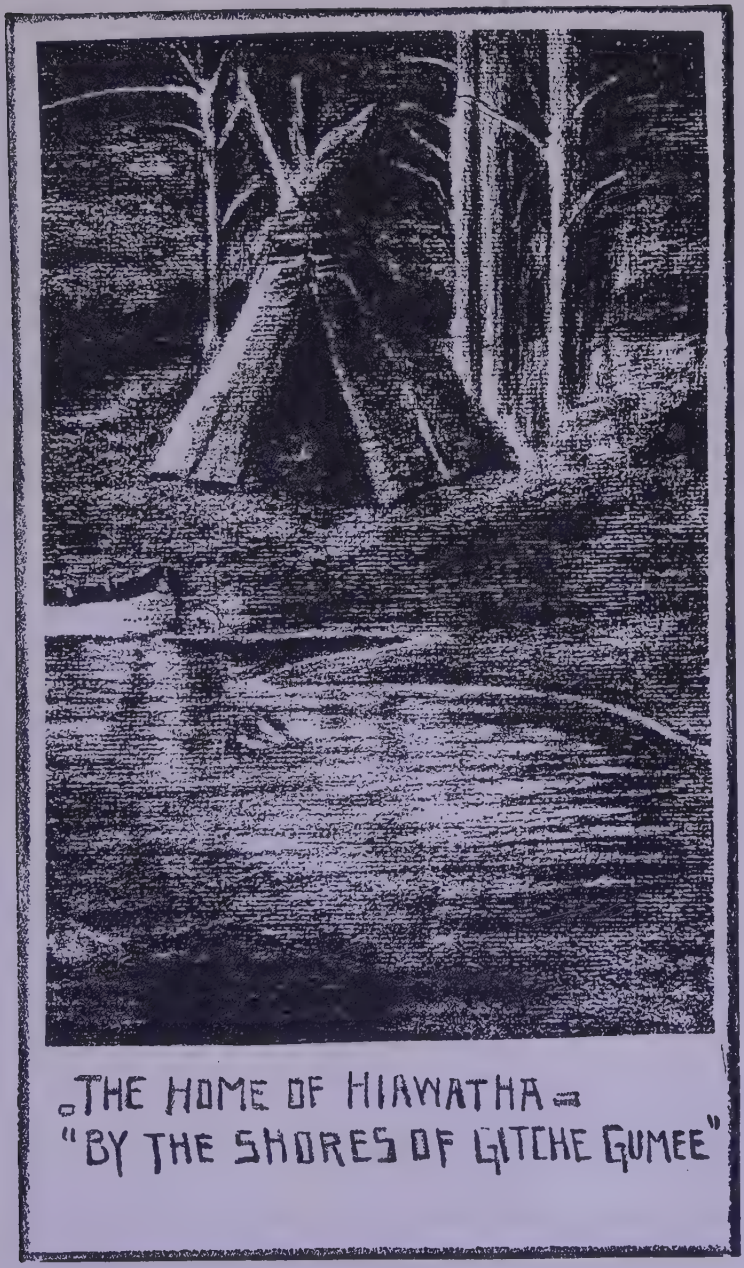
In the chill November,
Like a sunbeam bright,
Comes the glad Thanksgiving
Full of joy's own light.

Now at home's dear fireside,
Many a loving band
Meets in joy together
In this happy land.

And though we rejoicing
Taste Thanksgiving cheer,
'Tis the happy home-love
Makes the time so dear.

Laura Frost Armitage.

Lead the children in conversation to tell how they will spend Thanksgiving. Can you not plan to let the children cook something and prepare a dish for a school party? The first grade could prepare cranberry sauce; the second grade could bake beans, while the third could prepare the pumpkin for pies. If it is not possible to work this out in the school-



APPROPRIATE FOR BLACKBOARD OR IN CHARCOAL

room, you can give careful directions and the work may be done at home. Arrange for each one to contribute something for the school party. The long table used in kindergarten work could be utilized, or boards placed on boxes will serve the purpose. In what way may the art lessons serve to increase the pleasure and general attractiveness of the occasion? One school decorated the corners of the paper napkins with *Mayflower* designs, painted in blue. If the party is not too large, place cards may be hand-painted and some appropriate decoration may be added; or pumpkins may be cut from paper painted, and the name printed on the face of the round card. If the parents are invited, invitations simply printed by the children, with some added sketch appropriate to Thanksgiving, would be practical. A row of pumpkins in colored crayon, and a few words like the following would be appropriate for the invitation: "Please come to our party." The lessons in table setting and all the points in table etiquette will be some of the most practical art problems imaginable.

The teacher should have the blackboard work suggestive of the interesting pictures associated with Thanksgiving Day —a drawing of the *Mayflower*, a group of vegetables, or a large shock of corn would be attractive. The set of Thanksgiving pictures made by Lucy Fitch Perkins and sold by The Prang Company, Chicago, also the attractive Thanksgiving packet offered by the Davis Press, Worcester, Mass., are helpful. These pictures may be had for a nominal sum. Small reproductions of the pictures by George Henry Boughton, representing the Puritans, Priscilla, John Alden, etc., would be interesting to the children who are studying colonial times.

Test. Make a study from nature of a vegetable, in crayon or water colors.

Draw a bare tree from nature, using pencil or crayon.

Make a suitable illustration for blackboard work, suggestive of Thanksgiving.

Write a brief outline of work done during November.

FREEHAND PAPER CUTTING—THE STORY OF THE THREE BEARS

DECEMBER

December, oh, December dear,
We know your laughing face.
And who that jolly fellow is
That drives at such a pace.

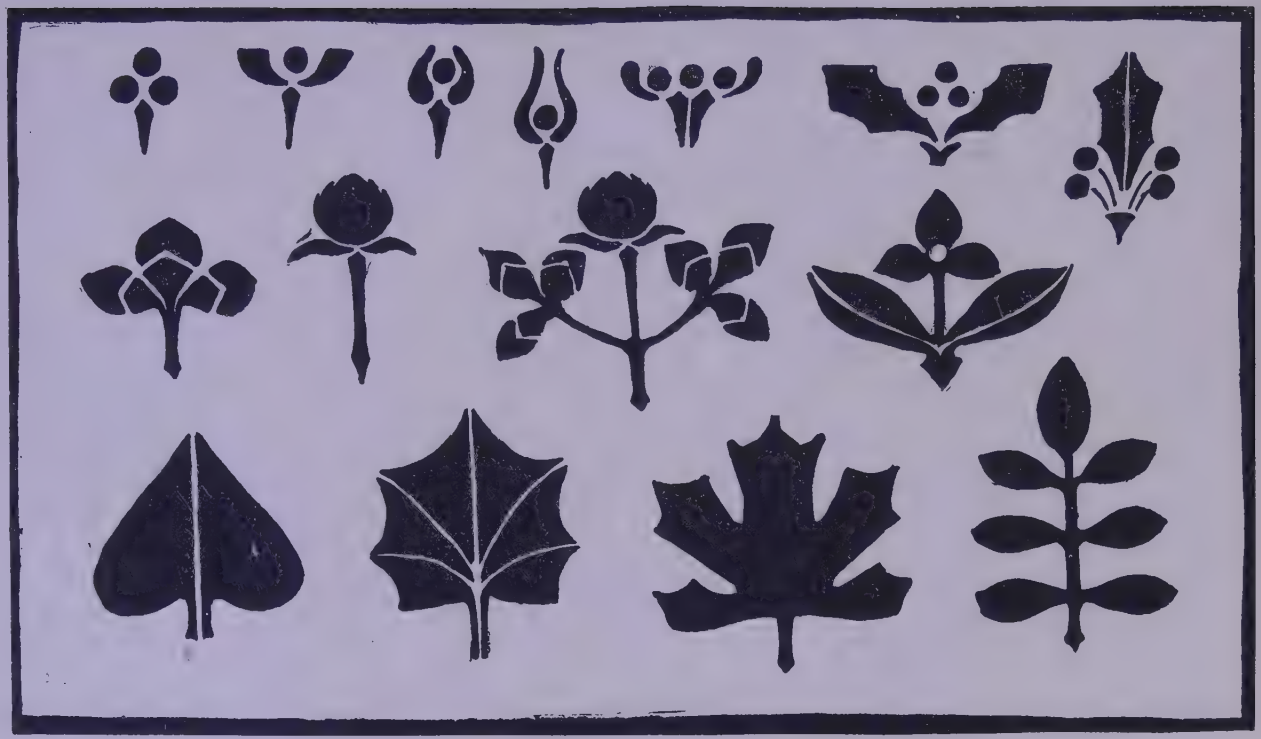
The prancing steed, the jingling bells,
The sleigh with toys heaped high,
Proclaim to every child on earth
That dear St. Nick is nigh.

LIZBETH B. CUMMINS.

19. Nature and Picture Study. Let the art work of December be influenced by the aspects of nature, by the winter games that interest children, by the stories, songs and poems especially suitable for December, and last, but not least, by the natural inclination the children have to celebrate the well-nigh universal holiday of Christmas by the making of some pretty gift for parent or classmate. Collect pictures illustrating the winter landscape and figures of children in winter sports. Some of the great world-renowned pictures of the Christ child should become familiar to the children. The following are suggested as being especially enjoyed by the children in lower grades:

The Madonna of the Chair.—Raphael.
Madonna of the Rabbit.—Titian.
Holy Family.—Van Dyck.
Holy Family.—Murillo.
Arrival of the Shepherds.—Lerolle.
The Sistine Madonna.—Raphael.
St. Anthony and the Christ Child.—Murillo.
Christ with the Doctors.—Hofmann.

20. First Week. WINTER SPORTS. Recall the pleasures of the Thanksgiving holiday, and ask the children to draw something to illustrate the good time they enjoyed. To make the work definite, ask a few questions such as the following: "Did you go sliding down hill? Did you go skating? Did you play snow-ball? Can you make a picture to show what you did?" Use crayons and have them represent the



CONVENTIONALIZED UNITS, TO DECORATE OBJECTS MADE BY PUPILS

color of the sky, the bare trees and the children at play. Leave the ground white to represent the snow. Ask one of the children to bring his sled to school the next day, so that one of the children may pose with the sled.

After the pupils have tried to express the picture from memory, then follow with a second lesson, using the sled and the child posing. If the children have some difficulty in representing the sled, have a lesson to show them how to represent the runners and the top fore-shortened. The pose could vary in different grades. In the first grade the little boy or girl may be pulling the sled, while in the second grade the boy or girl might be lying or sitting on the sled, in the position he or she likes to ride best; and in the third grade the girl might be sitting on the sled and the boy pulling.

Use manila paper, 9x12 inches, and crayons, in the first and second grades, while water colors representing figures in silhouette might be used in the third grade.

After the pose lesson has been given, the next lesson could be a memory lesson from the pose lesson, and to give a new feature the winter landscape could be added. Call attention to the white ground, the bare trees and the beautiful effects of ice, snow and frost.

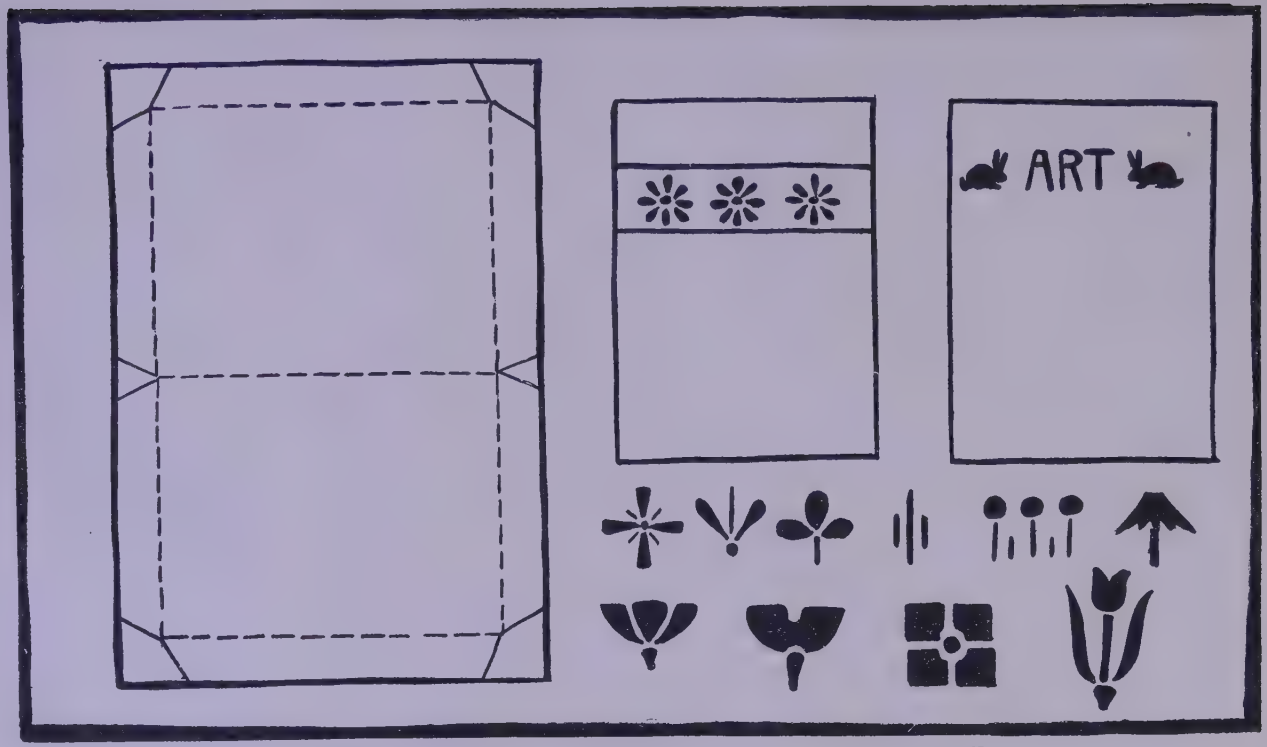
Read from Whittier's *Snowbound* such parts as the children enjoy.

21. Second Week. WINTER LANDSCAPE. Make a special study of the sunset effects in the winter landscape, also the evergreen trees. Paint a bright, pretty sky and represent the dark green evergreen tree on the hillside. Use manila paper and water colors or crayons.

Let the children illustrate the following lines:

> I remember, I remember, the fir trees
> dark and high;
> I used to think their slender tops were
> close against the sky.

The branches of the pine tree are very effective decoration at this time of year; they also serve admirably for an art



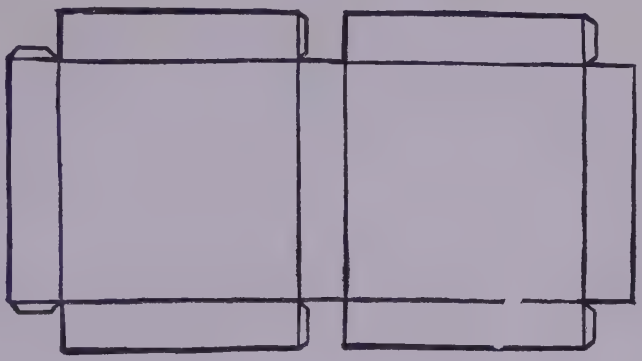
PATTERN OF PORTFOLIO, WITH SUGGESTED UNITS FOR A DESIGN

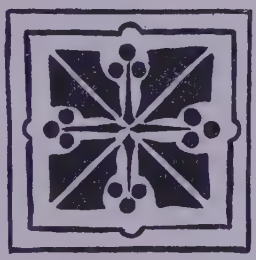
study. Let the children paint a wash to represent a bright-colored sky, and after that wash has dried perfectly let them use either black or green crayon and represent the long, slender needles of the pine. The evergreen tree and the cones make good units of design, and cuttings may be made to be used later to decorate the Christmas gifts.

22. Third Week. PREPARATIONS FOR CHRISTMAS. The art work this week should be correlated as closely as possible with the construction work. If Christmas boxes, calendars, picture frames, blotters, etc., are to be used as gifts, the art lessons should be directed to making designs suitable for these objects. The snowflakes make beautiful units that may be used in design work. Fold the paper and cut to suggest the beautiful geometric units. The evergreen tree conventionalized, the holly leaves and berries and the poinsettia are all seasonable subjects for designs. See illustration of *Design Units*, pages 351, 353; *Construction Work*, Vol. I, page 481.

One of the most acceptable gifts the child can make to the parent is a portfolio containing the school work the child has done during the term. To make the portfolio, choose some heavy, colored paper, brown, gray or green, and fold it in the center, to make a cover in which the work may be fastened. Fold the edges in, to make the portfolio more firm. If a portfolio is desired large enough for papers 9x12 inches, use paper 11x24 inches, allowing one inch to fold in on each side.

Let the children cut a unit of design from paper, and in the first grade these units may be pasted to form a design on the portfolio. In the second and third grades the unit may be traced around and painted with color in harmony with the paper. At Christmas the use of red and green in combination is permissible, and the holly and poinsettia make good units for design. The design should be conventional, and even in the lower grades the children may be taught to know that *pictures* are not suitable to use as decorations, when applied to constructed objects.





PATTERN AND DESIGNS FOR SQUARE BOX

Make some suitable blackboard drawings for Christmas; a Christmas tree full of gifts, Santa Claus in a sleigh with reindeer, a fireplace with stockings hanging, would be much enjoyed by the children. Print the words *Merry Christmas* or some other appropriate sentiment.

Test. Illustrate a winter scene with a figure of a child with a sled. Use crayons.

Draw a design to show an appropriate decoration for a Christmas gift made by your pupils.

Write a brief outline of work done during December.

JANUARY

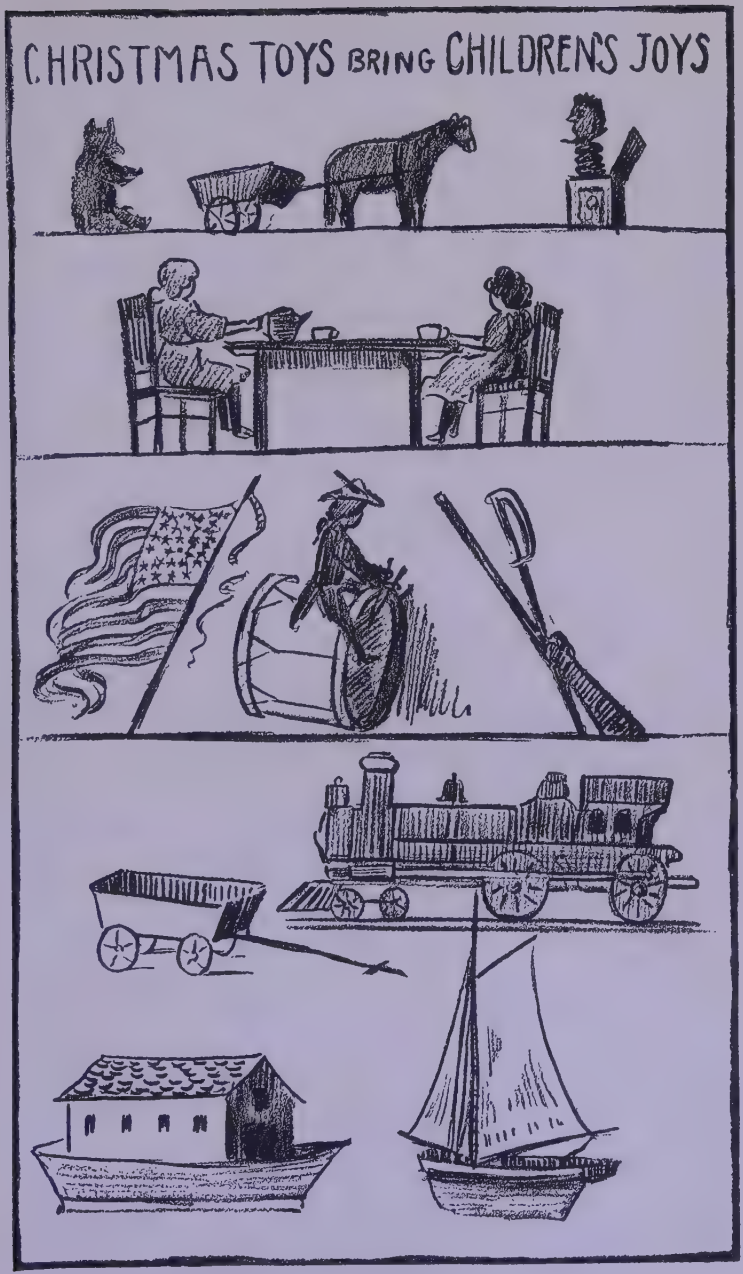
Who comes dancing over the snow,
His soft little feet all bare and rosy?
Open the door, though the wild winds blow.
Take the child in and make him cosy,
Take him in and hold him dear;
He is the wonderful glad New Year.

DINAH M. MULOCK.

23. First Week. TOYS. After the Christmas holidays the children will be eager to tell you about all the good things Santa Claus brought them. Let them illustrate freely, to show you some of their Christmas gifts. Ask the children to bring some of their toys to school to enjoy with the other children, and to use as objects for drawing.

It would be interesting to study how and where our toys are made. The Germans are the great makers of toys. A craftsman's guild near Chicago is also doing some very interesting work in making simple and substantial toys.

Select some of the simplest toys for the first grade. The toy animals are very good; the bear, dog, horse, cat or elephant would make good studies for silhouette work. These studies would be interesting subjects for freehand cutting and clay modeling. In the second and third grades more difficult toys might be used as studies, suited to the power of the children to represent them. The toy engine and train of cars, the carts and horses, are all interesting material. A


CHRISTMAS TOYS BRING CHILDREN'S JOYS

box of tools would serve admirably, and especially so when in the hands of the children suggesting their use. For example, let a boy demonstrate the proper positions of the workman in using the saw, the hammer, the plane, etc.

24. Second Week. (a) Object Drawing. Ask the children to bring a toy drum for use in illustrating the principle of the foreshortened circle. Hold the drum so that the children can see across the top, and ask them if it appears round, like a circle, or narrow, as an ellipse. Give a drill in drawing ellipses. Draw appearance of the drum when the top is a little below the level of the eye and appears like an ellipse. Then place the drum so that it is above the level of the eye and ask what face comes into view. The children should see the bottom face, and should note that this face, as the drum is held, looks like an ellipse. Have the children draw the drum as it appears a little above the level of the eye. Hold the drum as the drummer carries it in the band, and ask the children how it appears. Draw it as it appears when held in this position. See illustrations.

If the children should be familiar with the drum, choose something else that will demonstrate the same cylindrical principle, namely, that when the circle is seen obliquely, it appears to be an ellipse. The toy tub or pail will serve the same purpose. Draw in outline. The work from the objects could be varied by having a child pose, using the different objects. Poses of the boy with the drum, or girl washing, using the tub, will delight the children. See illustrations.

(b) The Pencil. In these exercises the lead pencil, a very soft medium, should be introduced. Previous to this the crayons, black and colored, should be used, as they respond more easily to the touch. The pencil can be introduced earlier, if the children have developed some power of expression. On the other hand, if their muscles are still weak, the soft crayon should be continued.

25. Third Week. Object Drawing (Continued). (1) *Soap-bubbles.* Continue object drawing. The first grade children should be given a drill in drawing circles. This can

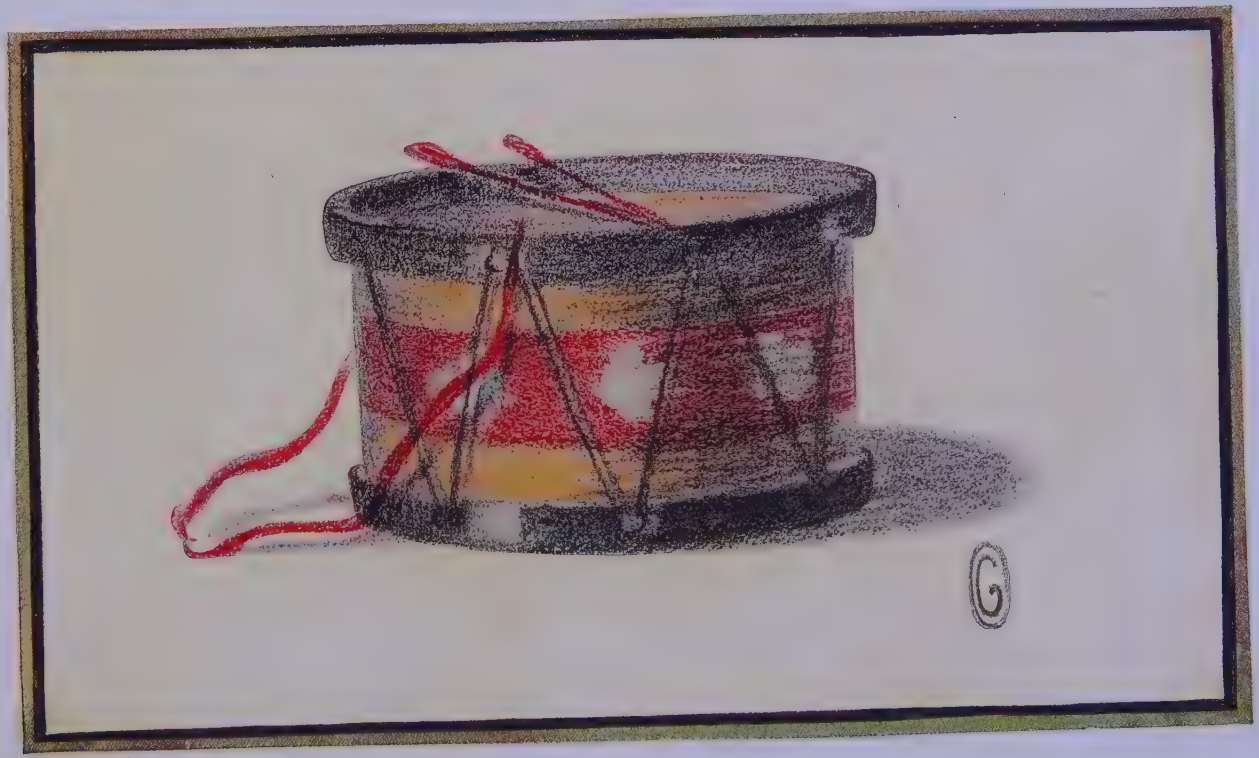
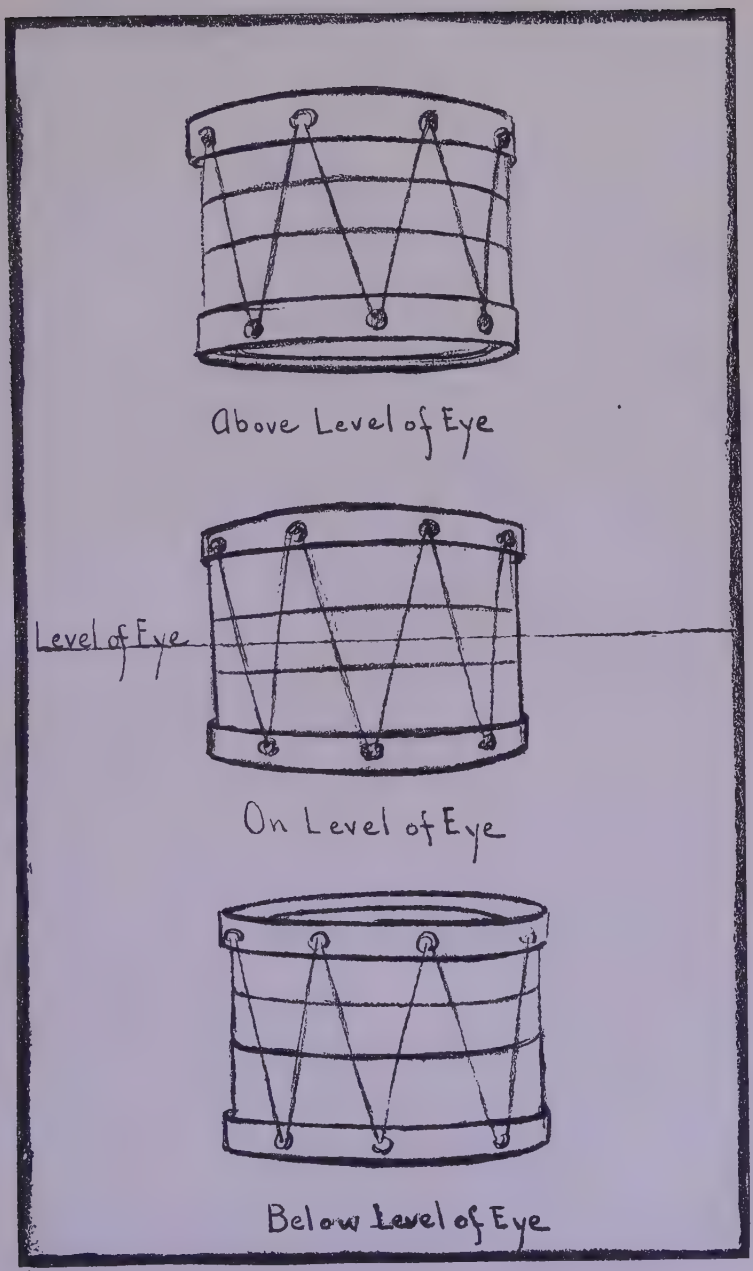


Plate Five

TOY DRUM



APPEARANCE OF DRUM IN DIFFERENT POSITIONS

be introduced by having a soap-bubble party, in which the children will see the perfect form and beautiful colors. Ask the children if they would like to try to represent the different sized bubbles or spheres. Have them draw with their pencils or crayons on the blackboard to represent the bubbles. Draw a circle. Show the children how to draw the circle by holding the pencil pointing to the left, and commencing at the bottom of the circle, moving around to the left, top, right and bottom. After a lesson in drawing, have a painting lesson to represent the bubbles.

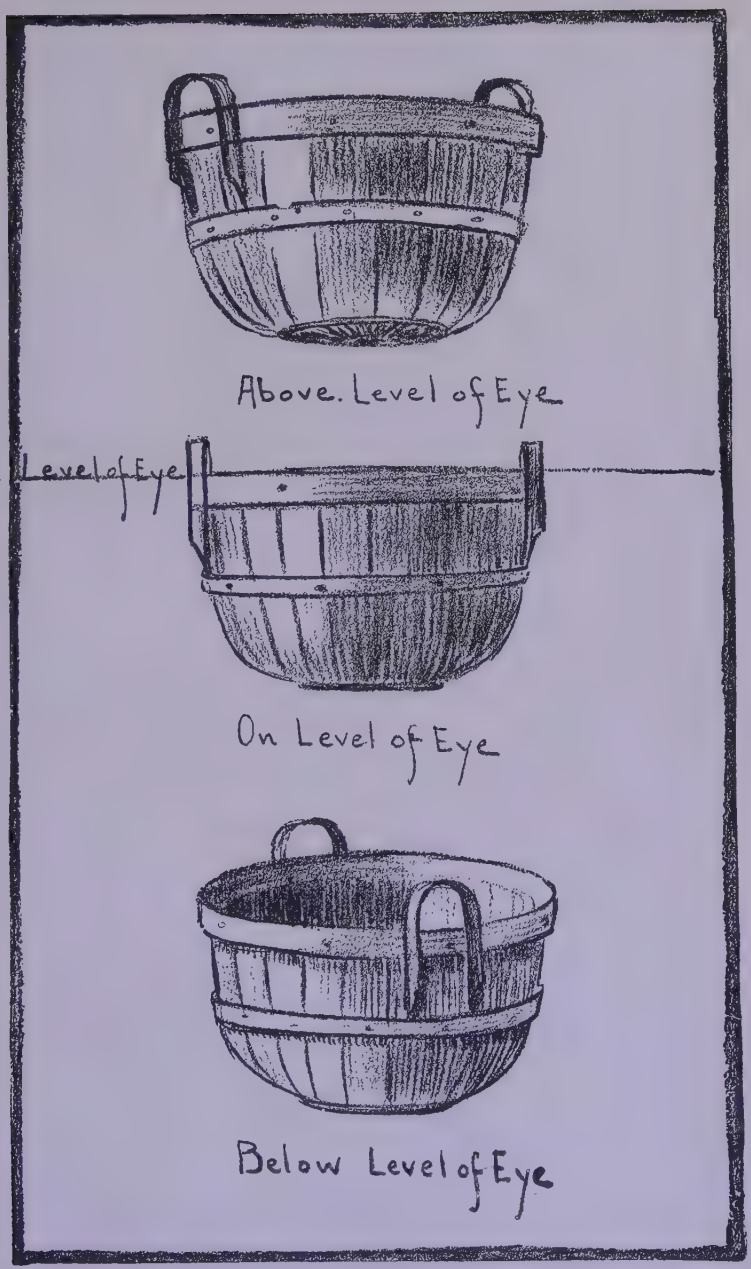
Method. Moisten the water colors. Take a brushful of water, and, starting in the center, represent the circle by water only. Then touch the colors lightly, and touching the wet circle, drop in the delicate colors to represent the irridescent colors of the soap bubble.

(2) *Lanterns.* The second and third grades could study the beautiful form and colors of Japanese lanterns. These will form attractive decorations in the schoolroom, hung in a corner or in the window, fastened to the window cord. The form of the lantern will review the sphere, or ovoid, and the black bands are cylindrical. When hung above the level of the eye, how do the bands appear? Can you see into the top or the bottom of the cylinder? Have the children show in their drawings what they see They may use the colored crayons to show the pretty, bright colored lantern and the black bands. The plain colored lantern will be the simplest and best to use. After a lesson using the colored crayons, try using the water colors.

Method. If the lantern is plain color, paint the shape of the body of the lantern, and then use all three colors mixed to make black. In representing the bands, paint them a tiny space away from the body, which may be still wet.

26. Fourth Week. OBJECT DRAWING (CONTINUED). Continue object drawing, and vary the program in the first grade by some illustrative drawing of stories or nursery rhymes. In choosing objects, select those that will be attractive to the children. A little set of dishes that the

Plate Four JAPANESE LANTERN



APPEARANCE OF BASKET IN DIFFERENT POSITIONS

girls could bring from home would be interesting. A lesson on how to set the table, and also how dishes are made, would be very instructive.

After a lesson on drawing the appearance of cups and bowls, in the first grade, and cup and saucer, or teapot, in the second and third grades, a final lesson could be given in representing a tea party. Let some of the children pose at the table, and after studying the simple lines of table and chair and sitting figure, ask the children to draw what they see, or what they can remember.

Clay modeling would be a very valuable form of study of the dishes. A bowl would be the easiest form to model. The cup with a handle might be attempted in the third grade. Do not attempt plates, as they are apt to be too thin and break too easily. See halftone illustration of clay vases made by children in the third grade.

Test. Make a drawing from some children's toys.

Make three drawings from some cylindrical object (not a drum) to illustrate the appearance of cylindrical objects in different positions.

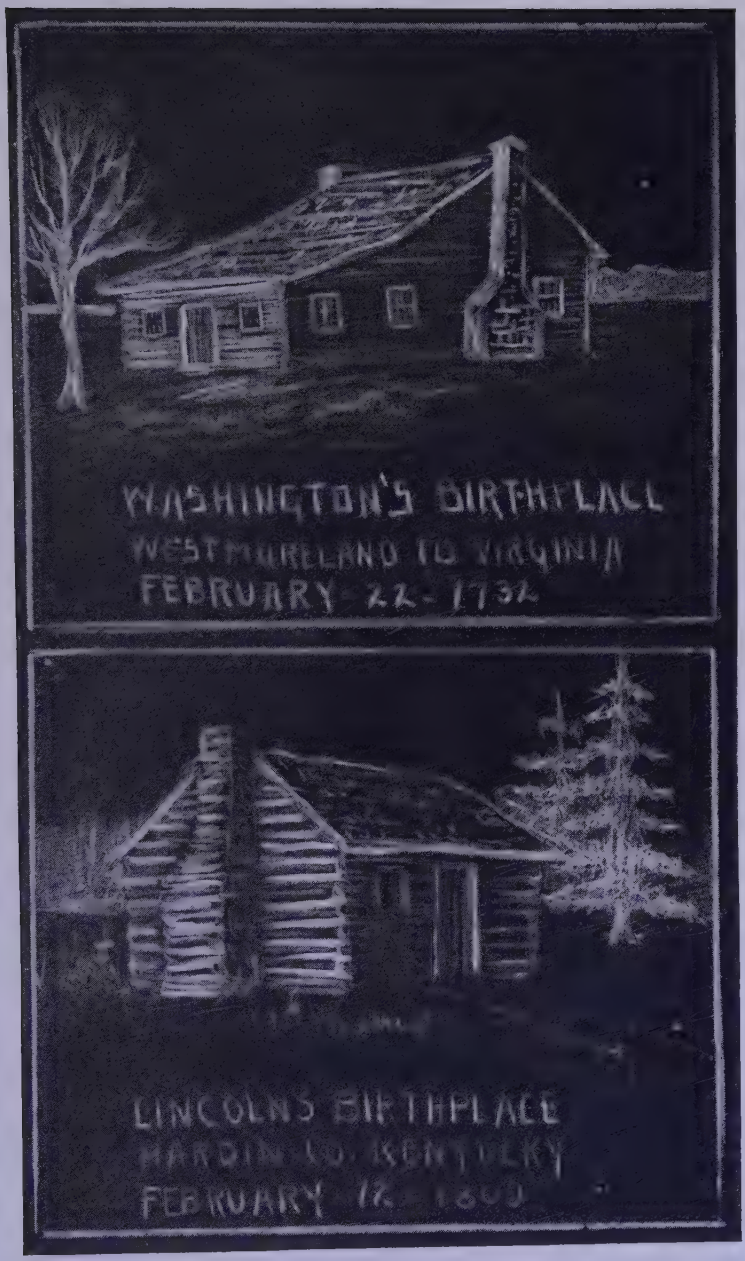
Write the principle governing the appearance of cylindrical objects.

Write brief outlines of work in drawing done in January.

FEBRUARY

'Tis splendid to live so grandly
That long after you are gone,
The things you did are remembered,
And recounted under the sun;
To live so bravely and purely
That a nation stops on its way,
And once a year, with banner and drum,
Keeps its thoughts of your natal day.

27. Preparation for Special Days. The month of February is rich in anniversaries which suggest many interesting things along the line of literature and art. The events of greatest interest to the children will be St. Valentine's Day


WASHINGTON'S BIRTHPLACE
WESTMORELAND CO. VIRGINIA
FEBRUARY 22 - 1732
LINCOLN'S BIRTHPLACE
FEBRUARY 12

CRAYON WORK

STUDIES OF FAMILIAR OBJECTS IN SILHOUETTE EFFECTS

and the birthday anniversaries of Abraham Lincoln, George Washington and Henry W. Longfellow. Have you good pictures of these men? Do you know the name of the American artist who painted the most popular picture of Washington? Learn something of this artist, Gilbert Stuart, who has given to the world the most acceptable portrait of the Father of his Country. It is called the *Athenaeum* portrait, from the fact that it hangs in the Athenaeum Gallery in Boston. It was left unfinished, hence the reason that the canvas is bare in the lower corner. The face is wonderfully well drawn, though a little too highly colored in the original painting.

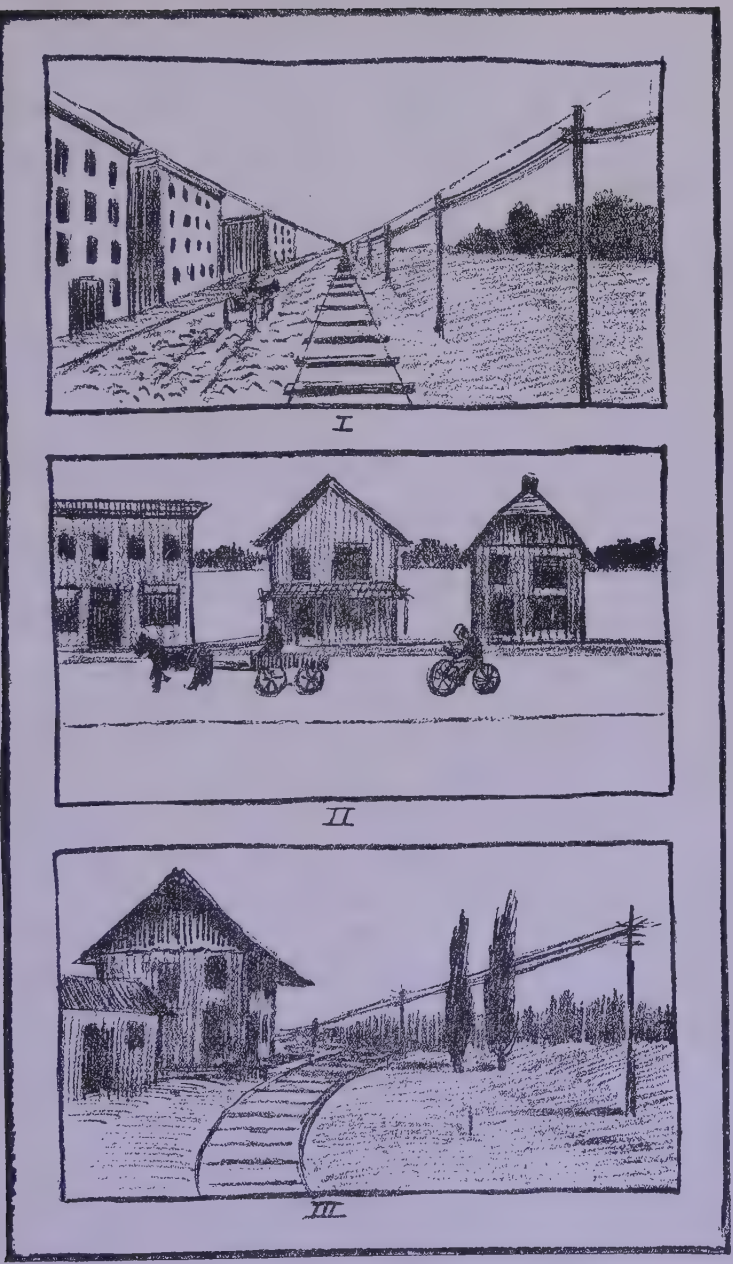
Another favorite picture of Washington represents him and his company of soldiers crossing the Delaware River. It was painted by the German-American artist, Emanuel Leutze, who has painted many of the large frescoes in the Capitol at Washington. It has considerable story-telling power, although the color in the original is cold and black.

The great American sculptor, Saint Gaudens, has given us the fine statue of Lincoln, the original of which is in Lincoln Park, Chicago; inexpensive reproductions of this great work of art may be procured in the penny pictures.

The picture called *The Boy Lincoln*, by Eastman Johnson, the original owned by Berea College, Kentucky, is of especial interest to children. It represents the young, awkward boy, sitting by the old fashioned fireplace, reading by the light of the open fire.

The object drawing should be continued this month, and since the illustrations connected with Lincoln and Washington include the drawing of the early homes, the problem of the drawing of houses and other rectangular objects should be taken up.

28. First Week. Receding Lines. Illustrate on the blackboard the appearance of the receding lines in the landscape as they are noticed in the road, railroad, telegraph poles and houses.



RECEDING LINES AND OBJECTS IN PERSPECTIVE

Method. First draw a long horizon line, then indicate the lines in a road directly in front of the observer, allowing them to meet at a point on the horizon; this point is called the *vanishing point.* Indicate also how trees are represented at different distances, diminishing in apparent size as they are more distant. Allow the pupils to follow by drawing with pencils and paper.

After a lesson on the general features of the landscape, make a drawing of the house. The first drawing may consist of a front or side elevation of the house, a drawing which gives the facts of the form; that is, proportionate height and length, the shape of the roof, and arrangement of windows and door. Such drawings may be made to represent the street, with its group of houses, stores and other buildings. Let the children try to make memory drawings from the streets with which they are familiar. After the children can represent the front elevation of the house, showing good proportion, then it will be well to introduce the house in perspective. See illustration, page 365.

29. Second Week. (a) PERSPECTIVE. Call the attention of the pupils to the appearance of the house when both side and front, or any two faces, are visible. Notice that one side may look very narrow from left to right, or *foreshortened*, as we say, and that the roof also appears narrower, according to our position in relation to the house. Let the teacher illustrate these points by drawing a house on the blackboard in angular perspective; that is, at such an angle to the observer that two faces are visible.

Draw the vertical corner that appears nearest to the observer, then place the remaining vertical corners, being careful to notice how far away they appear from the first vertical. Then draw the lines that represent the receding edges at the base of the house, letting them slant slightly upward toward the horizon from the corner nearest to the observer. All the lines in the roof will slant downward toward the horizon, being above the horizon line.

(b) *Lincoln's Birthplace.* After the children can draw a simple house in perspective, give them a picture of the old log house so familiar as the birthplace of Lincoln, located in Hardin County, Kentucky. The children would enjoy collecting sticks and making a log house similar to this one, and the pupils in third grade could also plan the old-fashioned stick chimney. After the house is built, the children may represent the house, working from the small model.

The free illustrations might include representations of some of the stories connected with the early life of Lincoln.

(c) VALENTINES. The second week's work will of course include the making of valentines, in honor of the good old St. Valentine, who, it is said, went about doing good to people unawares.

The freehand cutting and painting of hearts, with a simple love token printed neatly, would serve the purpose; or more elaborate ones may be planned which might be decorated with a flower border. Violets would be most appropriate for such a border.

30. Third Week. (a) THE NATIONAL FLAG. This week will include the work planned in commemoration of Washington, and will be unusually rich in material for art study. Pictures and stories of Washington should precede the art lessons proper. The story of the making of the first flag by Betsy Ross, in Philadelphia, the arrangement and number of the stripes and stars, the significance of the colors, are interesting topics for such lessons. The teacher should write these three words on the blackboard, and add the meaning of each as it is brought out: *White* stands for purity; *blue* stands for loyalty or truth; *red* stands for bravery or love. Explain that the thirteen stripes represent the original thirteen colonies, while the stars signify the number of states that are now in the Union. The first flag had the thirteen stars arranged in a circle on the square blue field, while the stripes were the same as they are now. Ask the children how many red stripes there are, and how they are arranged. Then suggest that they make a picture of the flag with their

colored crayons. The first and second grades could make a flag perfectly flat, while the third grade could represent it waving.

(b) Soldier's Hat. The first grade would enjoy making a soldier's pointed hat, like that which Washington wore. Make it of white paper and paste a five-pointed star, made of blue paper, on the side of the crown. For directions for making the hat, see Vol. I, page 493, Section 39.

(c) Soldier's Figure. After the children have made the hats and have marched with their soldier hats and drum, let the art lesson follow in representing the soldier pose. See illustration on page 329. Use crayon, or represent with ink or black water colors in silhouette effect.

Method. Draw lightly the skeleton figure as previously suggested, and then fill in to represent the shape of the body.

31. Fourth Week. Illustrated Stories. This week could include the free illustrations and memory drawings suggested by the stories told of George Washington when a boy. The children will enjoy illustrating the story of the cherry tree and the colt story as told about Washington. The teacher should draw pictures on the blackboard to illustrate the birthplace of Washington, the old homestead at Westmoreland County, Virginia, also the front of the old Mt. Vernon home, the first flag, etc. The following song, sung to the tune of *Marching through Georgia*, would be appropriate:

Sing a song of Washington,
Our hero brave and true;
Wave aloft our banner bright,
Our own "red, white and blue;"
Honor we today the man
To whom our praise is due;
Sing we of Washington, our hero.[1]

Test. Make a drawing to show the appearance of rectangular objects—house or box.

Write the principle of rectangular perspective.

[1] Laura Frost Armitage, from *Holiday Songs*, by Emilie Poulsson.

Make a drawing to illustrate an appropriate blackboard sketch for this month.

Write brief outline of work in drawing during February.

MARCH

The Spring is near, I know it well
Though cold air wraps the town;
Though on the hill and in the dale
The shivering trees are brown.

Though birds are hiding still afar,
Though oak leaves rustle dry;
Though frost is on the pasture bar,
She's near! I'll tell you why:

A sunbeam gave a merry sign;
"Just follow me," he said;
His dancing eyes shone into mine;
I lifted up my head;

I looked across a vale of snow,
And there in hoods of gray
The pussy willows whispered low,
"The spring's not far away."

LYDIA AVERY COONLEY.

32. The Month of Awakening. The month of March suggests many activities, relating both to work and play, that may be turned to account for lessons in art.

March is the month of the awakening in nature, and the children will be interested to find the first buds on tree and shrub. The animal world, too, is especially interesting at this season, and if the children are studying any phase of animal life, it will afford good material for art study. The pet rabbit, cat or dog could be brought into the schoolroom for special study.

33. First Week. (a) ILLUSTRATED POEMS. Let the children dramatize or act out in play the work of the week, as this little rhyme suggests:

On Monday when the day is fair,
I wash my dolly's clothes;
On Tuesday I can iron them
Although it rains or snows;
On Wednesday I go out to play,
I take my dolly too;
On Thursday I receive my friends,
I've nothing else to do;
Then Friday is the time to clean
And set all things to rights;
On Saturday my doll and I
Walk out and see the sights.

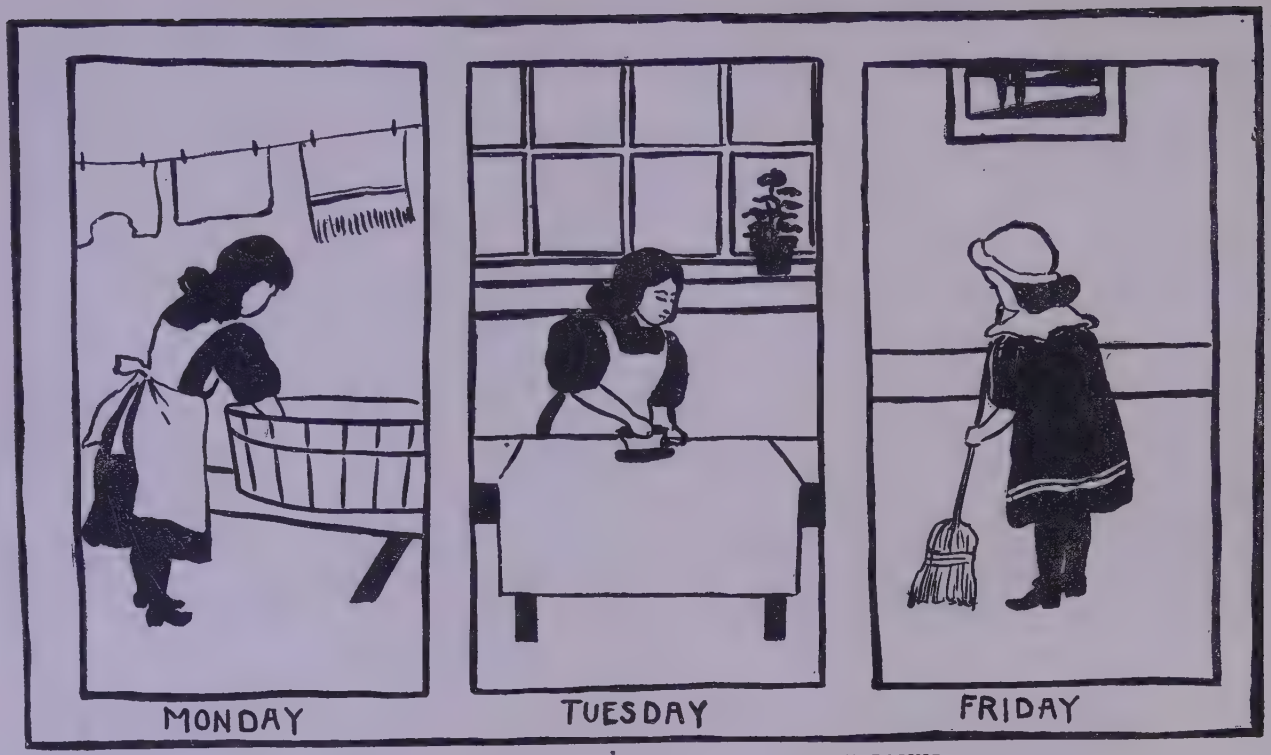
Ask the children to bring a toy tub, washboard and iron, a doll and doll carriage. Different children may be called upon to act out the different scenes. After the part has been dramatized, ask the children to make a memory drawing for each day. Let the work cover the lessons for the week, and use different mediums for the representation. The crayon will be the simplest medium, and the illustration of children's work will suggest the treatment.[1]

The third grade might try an outline drawing and painting of the same in water colors, as suggested in the colored illustration. See Color Plate section.

(b) PAPER CUTTING. Freehand cutting of the various utensils used in the week's work would suggest such things as a bench, tub, pail, iron, broom or sweeper. These cuttings may be mounted on black paper, which may be secured from a picture framer. It is the inexpensive black paper that is pasted at the back of pictures, and sells for a few cents per yard.

34. Second Week. BUDS AND BRANCHES. Ask the children if they have been collecting the budding tree branches. The pussy willows, lilacs, horse chestnut and poplar all make interesting and beautiful studies. Place the branches for the children to draw from as you did in the fall, by pinning

[1] The teacher may be interested to know that the children in the third grade in the Training School, Western State Normal School, Kalamazoo, Mich., made the wash bench and the clothes horse that are pictured.



ILLUSTRATING THE WEEK'S WORK, BY CHILDREN POSING

them on the pasteboard easels and placing them on boards across the desks.

Illustrate freely, by blackboard drawing, the soft, furry pussy willows. White crayon on black paper is also very effective, as well as the black crayon on manila paper. The horse chestnut buds, with the tender yellow-green leaflets and dark, waxy bud scales, are very beautiful represented in water colors.

35. Third Week. STUDIES IN FIGURES. The children will be playing the spring games, marbles, jumping rope, and baseball, about this time. The teacher will take advantage of the natural inclinations of the children to make interesting subjects for art study. Ask the children to choose some game, and let some few children be called upon to act out the game for the rest of the school to study. The silhouette would be the easiest way to express these figures suggesting action, but the skeleton lines should precede, showing position of the body and limbs. In playing ball, let one boy act out the work of the pitcher, another the catcher, a third the one at bat.

Caution. Let the game be played without the ball, as it might end disastrously to have the ball struck in the schoolroom.

36. Fourth Week. (a) OUTDOOR STUDIES. The March winds suggest many picturesque situations. The flying of kites is very good, as is also the children running for their hats, their clothes and hair being tossed about by the wind. The March landscape, with smoke blowing from the chimneys, the clothes blown on the line, are all typical of the month of March. Ask the children to illustrate what the winds do, and after a conversational lesson let them choose some phase of the picture and represent it in their own way.

If crayon is used, the picture may be commenced by drawing first the horizon line, then drawing the house, trees or children flying kites, or whatever the theme may be. If water color is used, proceed according to the method indicated in the fall, applying first a water wash, then with color

Plate Six

THE MORNING WALK

FIGURE PAINTING IN SILHOUETTE—CHILDREN'S WORK

or black, to indicate the tone of sky, ground and figures. The figures should not be added until the background color is nearly, if not quite dry.

(b) Picture Study. The pictures painted by Millet, the great French peasant painter, should be studied at this time. The children will learn much about how to treat a figure in a simple manner, by studying and even attempting to copy *The Sower*, *Feeding the Hens*, *Churning*, *Shepherdess Knitting*, *Peasant Grafting a Tree* and *First Steps*. Millet has shown us, as perhaps no other artist, the beauty in everyday life. Millet was a peasant, born amid the hardships of the poorer class, and he spent a life of toil in the effort to make popular the subjects which he had chosen to immortalize. Although his work was not appreciated during his lifetime, he has since been hailed as the Poet Painter of the Peasant. We are all his debtors in helping us to see and appreciate more the work of those who toil. Let these pictures by Millet be given a place of honor in every schoolroom, for "A good picture is a silent teacher."

Test. Illustrate by figure drawing from a child posing, some work of the week as the rhyme suggests. Use crayons.

Make a study of some budding tree branches.

Write a brief outline of work done during March.

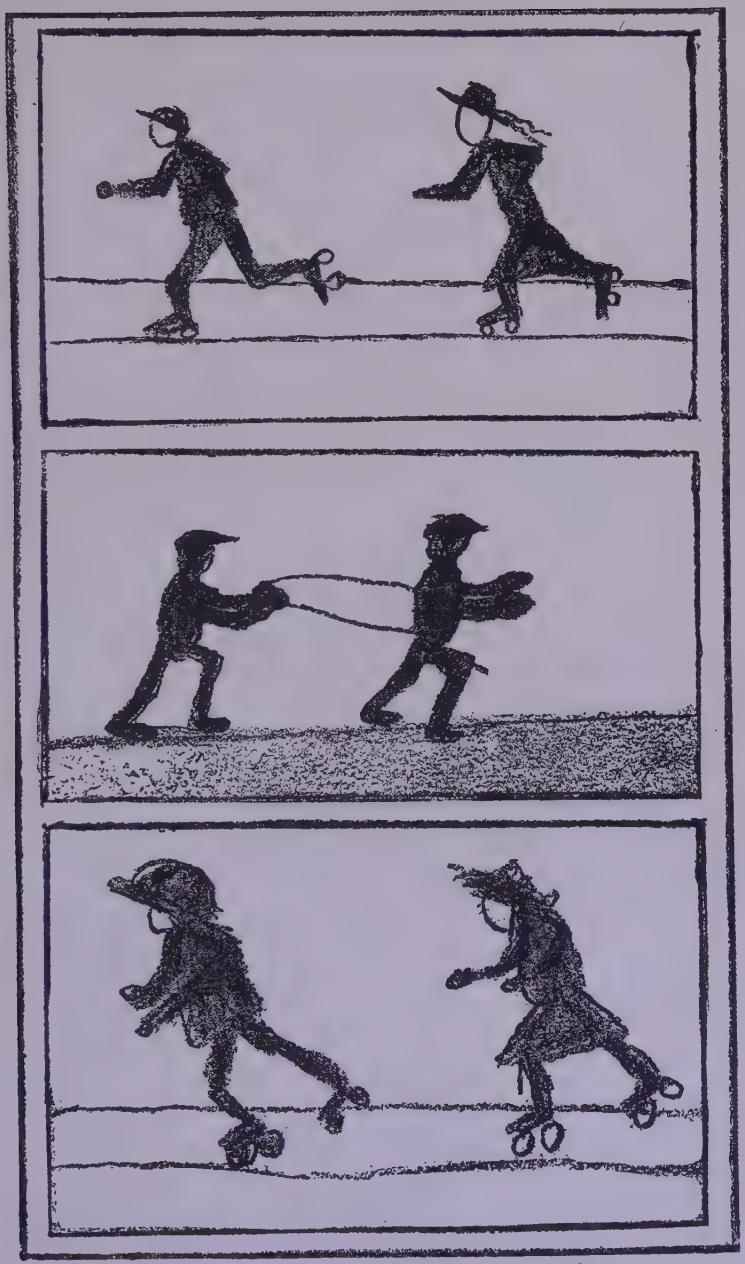
APRIL

The alder by the river
Shakes out her powdery curls;
The willow buds in silver
For little boys and girls.

The little birds fly over,
And oh, how sweet they sing!
To tell the happy children
That once again 'tis spring.

Celia Thaxter.

37. Springtime. To enumerate the joys of life in the spring is to suggest abundant material for art study. The return of the birds, the new growth of the buds, the first



ILLUSTRATING CHILDREN'S GAMES—CHILDREN'S WORK

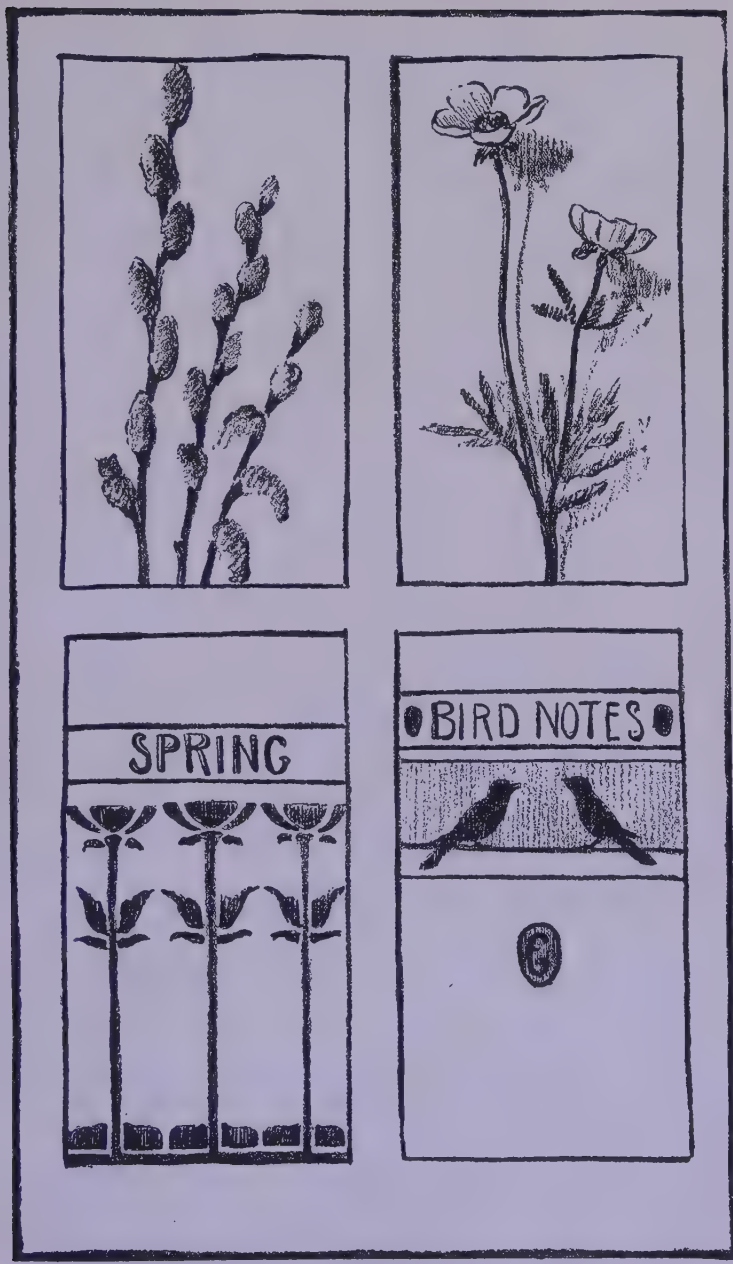
flowers, the delicate spring landscape, the animal life, and spring gardening are all fruitful sources for observation and expression. Ask if the children have been keeping a record of the return of the birds during the month. Find out if they have seen a robin, a blue jay, a bluebird or a flicker, and if they have helped to feed the birds and helped to build their nests by putting out some string and hair for them. It is of assistance to have bird pictures in the schoolroom. Those published by A. W. Mumford, Chicago, are good and inexpensive. Let the children copy some of the easiest ones; the crow, the robin, bluebird and blue jay are comparatively easy.

38. First Week. (a) *A Study in Birds.* Encourage the children to try to represent some of our bird friends. The crow or blackbird would be an easy one to commence with. Notice the form of the bird's body. It is very much like an egg in shape. Make this egg shape first, and then add the head, tail, wings and legs. Notice the position of the legs—how far back they are placed. Notice, also, the number and position of the toes.

(b) Bird Booklet. Let the children try cutting the form of a bird. Use the bird cuttings to make a design for a bird booklet. Fold the paper to make a cover for the bird composition and pictures you have been making. Use a bird cutting and trace around the unit, and arrange the tracings to look well—two arranged symmetrically, or in a row across the top of the cover. Paint the units a flat color that will be in harmony with the color of the cover paper.

The children should know that the picture of a bird is not suitable decoration for a cover, and the bird unit, in silhouette, painted in flat colors, well arranged in the space, becomes a true decoration.

39. Second Week. Garden Scenes. This is the time of year that gardens are made. Interest the children in representing the subject by such questions as follow: "Who has a garden at home? Can we make a school garden? Who can bring a spade, a rake, a shovel, and a hoe for use in gard-



SPRING BUDS AND FLOWERS; DESIGNS FOR SPRING BOOKLETS

ening? What shall we plant in our school garden? Can we have both flowers and vegetables? Whose pictures do we think of in connection with gardening and farming? Have you a picture of Millet's *Potato Planting*, or *Going to Work* or *The Man with the Hoe*? Do you think you could represent some of the scenes from your gardening?"

Let a boy pose as if he were spading, or raking, and represent the figure with the proper action. The children in the first grade would enjoy cutting the pictures of the utensils and mounting the cuttings on dark paper.

40. Third Week. SPRING LANDSCAPE. The wonderful changes going on in nature will be very marked; "the green grass comes creeping everywhere," the trees are putting on their dresses of yellow-green, the streams are flowing, and the beauty of the spring landscape is upon the world. Represent the spring landscape in water colors. Show the children some of the spring landscapes made famous by the great French artist, Camille Corot. His pictures, *The Dancing Nymphs*, *The Children Dancing a Round*, *The Lake*, *The Willows* and many others reveal the delicate beauty of the springtime as few artists have expressed it. The willow was his favorite tree, and the early morning of spring was his chosen time for work. His groups of trees are considered some of the most masterful effects ever portrayed on canvas. The work of Corot is a great contrast to that of Millet, although the two artists worked in the same little village and were great friends.

41. Fourth Week. (a) SPRING FLOWERS. The spring flowers are probably in abundance at this time, and the tulip, daffodil and fleur de lis are in the gardens, while the wild flowers include the hepatica, anemone, wake robin, Jack-in-the-pulpit and others. Choose the large simple ones rather than the small ones, and let the children paint the tulip, fleur de lis or Jack-in-the-pulpit.

Place the flower in position, so that the children may study its form and color. Use the water colors and paint the flower in the free brush method, without outlining. After

"ULYSSES PLOWING"—FREEHAND CUTTING BY PUPIL IN FIRST GRADE

the flower is painted, express the stem and leaves in proper color. See the color plate illustration of tulip in color.

(b) May Baskets. Great interest will be shown this week in collecting the spring flowers and making a May basket to leave at some friend's door on the eve of May day. Let the children plan a design in delicate colors on the May basket, using some of the spring flowers in a conventional way, as the illustrations suggest.

Test. Make a design appropriate for the cover of a bird booklet. Use ink or black water colors.

Paint a spring flower in water colors.

Write a sketch of a story which would be a suitable subject for free illustration.

Write a brief outline of work done during April.

MAY

May shall make the world anew;
Golden sun and silver dew,
Money minted in the sky
Shall the earth's new garments buy.
May shall make the orchards bloom;
And the blossoms' fine perfume
Shall set all the honey-bees
Murmuring among the trees.
May shall make the bud appear
Like a jewel, crystal clear,
'Mid the leaves upon the limb,
Where the robin lilts his hymn.
May shall make the wild flowers tell
Where the shining snowflakes fell;
Just as though each snowflake's heart
By some secret, magic art,
Were transmuted to a flower.
Is there such another, pray,
Wonder-making month as May?

Frank Dempster Sherman.

42. Animal Life. Are we all partakers of this "wonder-making month of May?" If necessary, a part of the time devoted to art should be given to the study and enjoyment

Plate Seven

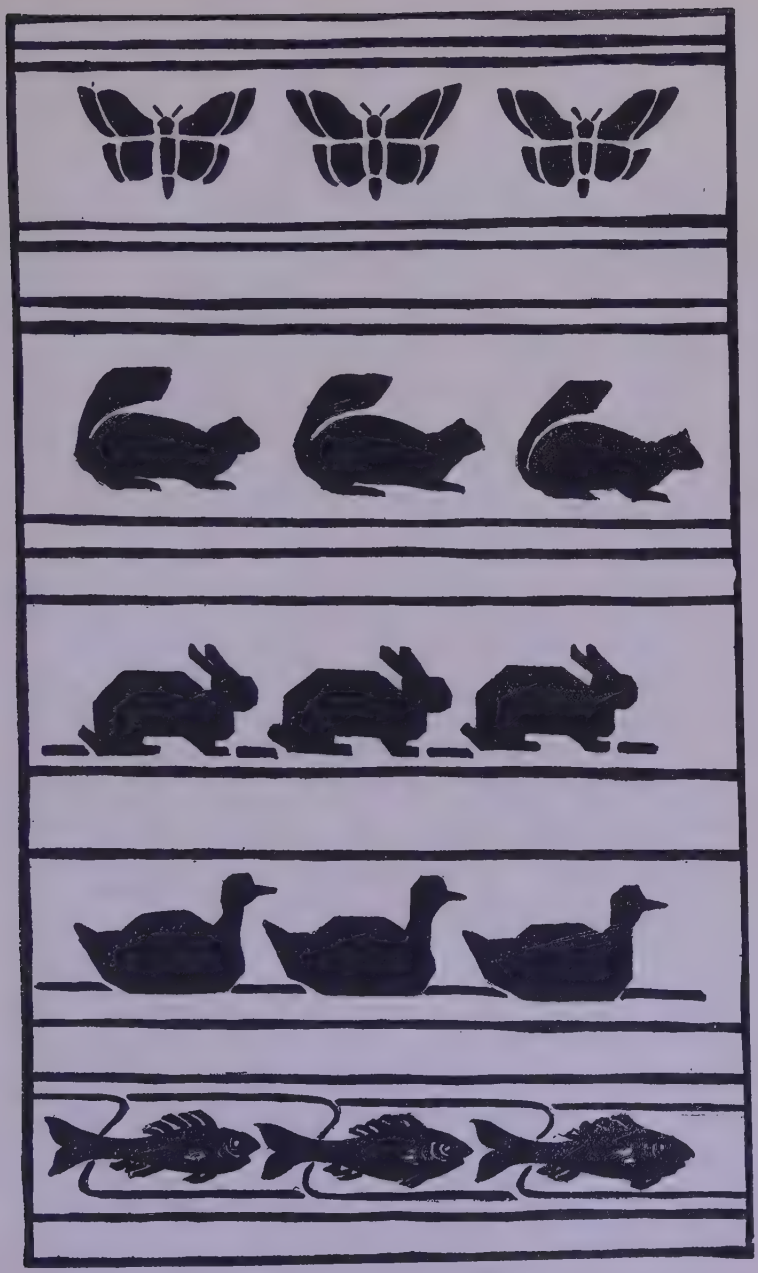
TULIPS

ANIMAL STUDIES IN CRAYON

of this "making of the world anew." What joy to find the first spring blossoms, to hear the song of the birds as they flit from one lacy tree top to another! To watch the life in the brooks, the water bugs, fishes, frogs and frogs' eggs, and the new life on the farm, the little chickens, rabbits, pigs, lambs and calves—all these are of great interest to the children. Let us collect pictures of animals and learn something of the life and works of the great animal painters. Rosa Bonheur was one of the most successful animal painters. Do you know her pictures the *Horse Fair*, *The Return from the Fair*, *Brittany Cattle*, *Oxen Ploughing*, *Flock of Sheep*, *On the Alert*? These represent some of the best animal pictures ever painted. Edwin Landseer, the English artist, was especially successful in representing dogs. His pictures, *Dignity and Impudence*, *A Member of the Humane Society*, *The Spaniels*, his own portrait with two favorite dogs, called *The Connoisseur*, and also his picture of the blacksmith shop called *Shoeing the Bay Mare*, are among the best known of his works.

43. First Week. (a) Study of Animals. Ask the children to bring some of their pets to school, such as rabbits, chickens, or a gentle dog or cat. Let the children have a chance to see the animals for some time before an attempt is made to represent them. Call their attention to the form of the body. Is it long or short? How are the legs attached, and what is the shape of the head, ears, etc.? After the children have answered these questions, ask them if they would like to represent the animal as a shadow picture, using black paint or water colors. It will be easier for the pupil to begin with the form of the body and add the head and limbs.

(b) Designs. After a lesson on making the animal form in silhouette, try using it as a unit of design for a composition cover. Make a cutting of the animal form which you can use as a pattern, and trace around it, making a border design. See illustration. The animal can be used also in a design which may be worked out on a book bag, working in cross stitch.



CONVENTIONALIZED DESIGNS

Clay modeling may be utilized as a fine medium to express the animal forms.

44. Second Week. Stained Glass Effects. What gorgeous colors in the spring flowers! Lead the children to see that the daffodil, buttercup, dandelion and sunflower are the yellow ones, and that the orange flowers are the tulip and nasturtium; the red flowers are the geranium, carnation and some tulips. Ask the children which flower is green. (The Jack-in-the-pulpit.) Which are blue? (The forget-me-not, the blue-bells, bachelor buttons, love-in-the-mist.) Which ones are violet? (The violet, thistle, fleur de lis and clematis.) Ask them also such questions as the following: "Where have you seen all these beautiful colors besides in the rainbow and the ray of light through a prism? Did you ever see them in the church windows? Let us make some stained glass effects."

Method. Wash the paper over with a water wash, and then touch the colors in fresh from the cakes, and let them blend together on the wet surface. You may make some of the windows to represent the colors in the tulip, bright red, orange and yellow, with some green like the leaves added, or like the fleur de lis, with violet and green blended together.

The first grade could cut out a quarterfoil of black and paste over the colored paper to represent the black leaded lines. The second grade could cut a simple Gothic shape like the church window, while the third grade could cut the Gothic shape with a circle in the upper part. If you have no black paper, the manila paper may be colored black.

45. Third and Fourth Weeks. Articles for the Home. Open the lesson with a few questions, such as those following: "How would you like to make something very pretty to take home for your mamma? What shall it be? We want to make something all ourselves." The first grade could make and decorate a holder; the second grade, a little mat; and the third grade, a top for a pillow. The material may be of burlap or denim; either would be good and inexpensive for use in this construction work. The iron-holder is square, and therefore you must make a design and cut a pattern from a

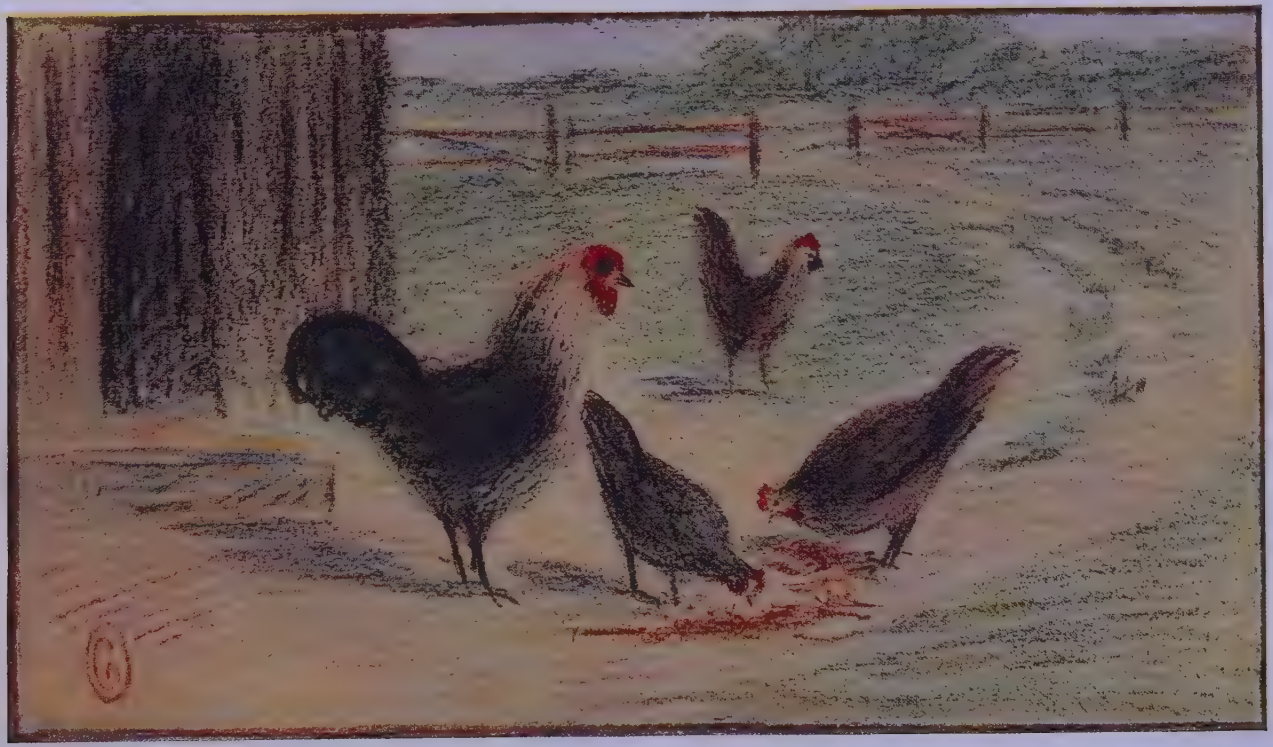
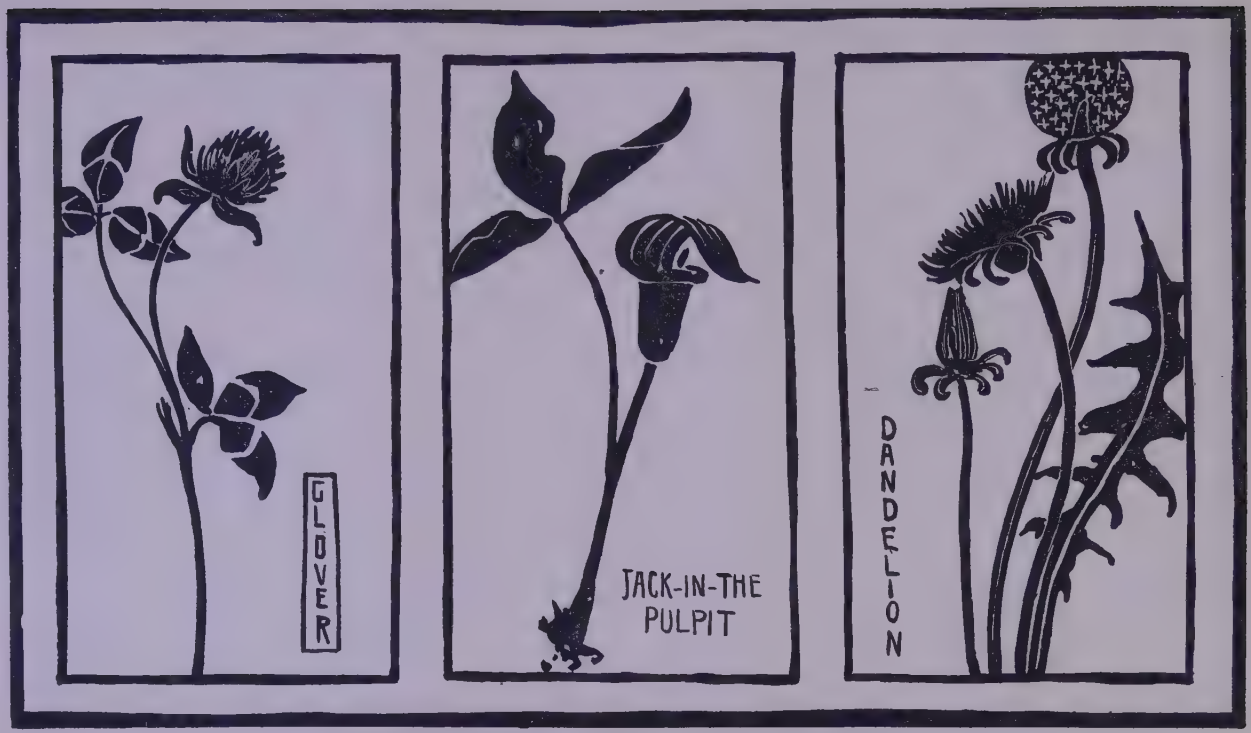


Plate Eight

IN THE FARM YARD



SPRING FLOWERS, IN WATER COLOR OR INK WORK

square paper. The rosette, cut by folding the paper three times, would make a good form. It may be cut with straight or curved lines.

The conventionalized leaf or flower would make an appropriate decoration for the mat or pillow. Cut the pattern or stencil of paper, and then trace around it and paint it with your water colors, or color it with crayola crayons, which is a waxy medium, and rubs off easily on the cloth. The wax crayon is made permanent by pressing on reverse side with a hot iron. Do not use colors too bright and crude, but make them gray by using a little of all three colors in any color you use. The dull greens and browns are the most appropriate colors.

The design may be carried out on squared paper, and then the cross stitch used on the fabric. If the cross stitch is chosen, a coarse canvas in which the threads can be easily counted should be used.

Third grade children can often lend their services in ornamenting curtains or other draperies for the schoolroom. On a large object let each child work one unit in the design.

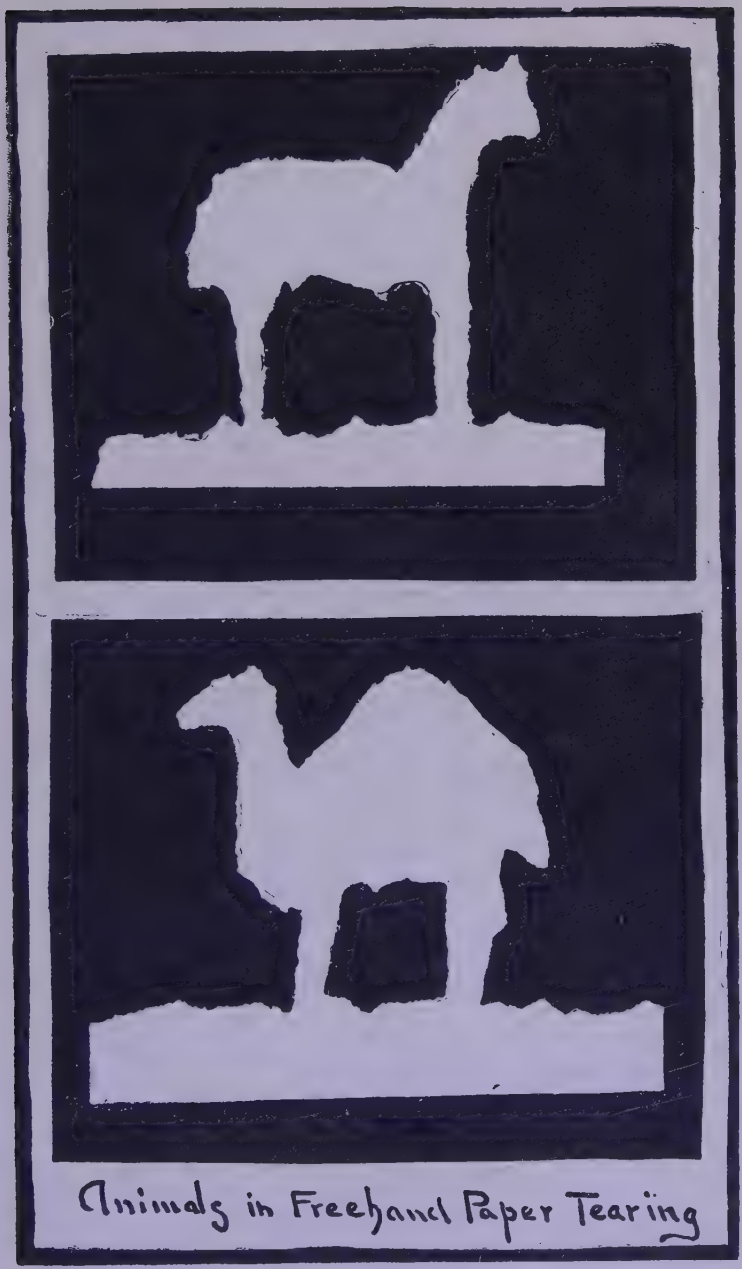
The climax of the year's work should be something made for use in the home, and beautified by the taste and skill of the little workers. The teacher should take advantage of opportunities as they come to impart lessons of good taste in the decorating and furnishing of the home. The construction and furnishing of a large doll's house by the children affords an excellent means for carrying out this plan. In furnishing this house, the children will use their construction and art work. Wall paper, curtains, rugs and furniture should all be made by them.

Test. Make a drawing from an animal.

Draw a design from flower or animal form to use as decoration for children's work in construction.

JUNE

O lovely June! O lovely June!
You're everything together;
Your skies so fair,
Your flowers so rare,
Oh stay, delightful weather!



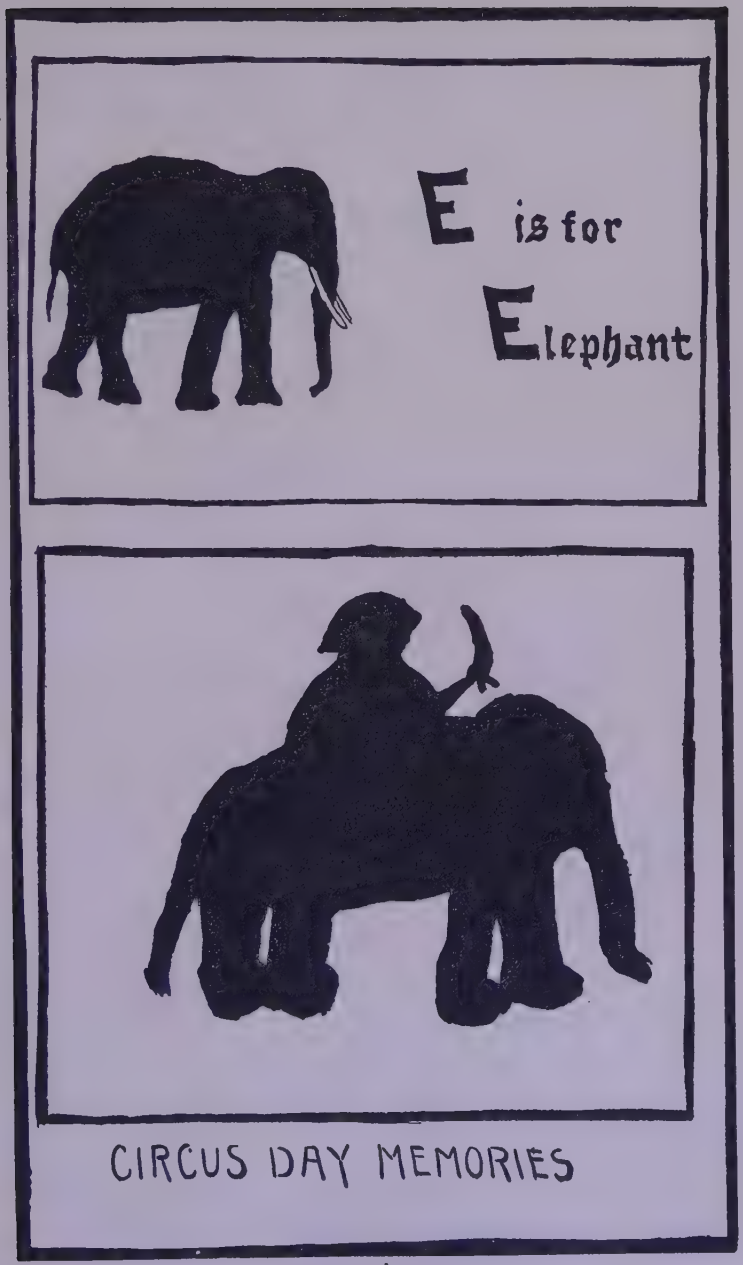
CHILDREN'S WORK

46. The Annual Exhibition. The month of June has been called the birthday of the year, and certainly everything in nature has life in its fullest, and we are all re-created by the fullness thereof. To the children June stands for picnics, circus day, fishing, wading or swimming, closing days of school, and vacation time with life in "God's Out-of-Doors." Are you planning to have an exhibition of the children's work, and to invite the parents to visit the school? The opportunity of seeing the regular school work would be enjoyed by all parents.

The best way to exhibit the children's work in art is to arrange the studies on the gray pasteboard mounts. Do not place too many on one mount; six papers 6 x 9 inches, or three 9 x 12 inches, placed with equal marginal spaces, would be acceptable mounting. Paste the studies with a little LePage's glue at the four corners. Fasten the mounts together by tying them with gray cord through holes punctured at equal distances from the edge. Three hung together, if placed vertically, or four if arranged horizontally, would make a line extending from the picture moulding to the lower edge of the blackboard. Place loops at the edge of the upper mount, and hang with picture hooks. A screen covered with burlap is a very convenient means of making class exhibits, and it is especially desirable that exhibits of all the children's work should be made occasionally.

47. First Week. INVITATIONS. Tell the children that they may make invitations to send to their mammas and papas, asking them to come to the exhibition. The first grade might print the single word *C O M E*, and the date. The second and third grades could paint the words *Please Come to Our Exhibition*, and the date.

Use colored paper, or tint the manila paper, if you cannot secure the colored. Use a sheet 6 x 9 inches, folding it to make a little booklet. Decorate the outside page with a simple unit of design, using either a conventional flower or animal unit. Paint in black or appropriate colors. The brown-eyed Susan would be a good flower form. Use yellow and brown in this study. On the inside page print the invitation. Let the



CHILDREN'S WORK

children practice the printing several times before making the invitations. Print the words on the board to show the children good lettering.

48. Second Week. (a) Outdoor Studies. This will be a good season to plan a school picnic. What good times the children will have, preparing the lunch, setting the table, playing games, perhaps wading, fishing or swimming! Tell the children to illustrate something they like to do at a picnic; show in a picture what they like to play. They may show, too, if it were by the lake or river or in the woods that the picnic occurred.

(b) Animal Studies. Perhaps you can introduce such a lesson as this at a time when a circus is coming to town. Ask the children to show some of the animals, and begin by making a picture of the elephant in crayon or water colors. The teacher should obtain good pictures of the animals. Freehand cutting and clay modeling of the animals would be very good lessons for form study. See illustrations of elephants in silhouette and clay modeling, showing the children's work.

(c) Flags. Flag Day comes on the 14th of June. Let the children celebrate by making a picture of the flag on the blackboard in colored crayons; let them copy from the drawing or from the flag itself, making a study in color, using colored crayons or water colors.

Print on the board and have the children recite any appropriate stanza, such as the following:

'Tis the star spangled banner
Oh, long may it wave,
O'er the land of the free,
And the home of the brave.

49. Third Week. Art Portfolio. Make a portfolio in which to place the art work of the year, so that each pupil may carry his work home. Use heavy wrapping paper and fold the paper as indicated in the illustration. The full size of the sheet from which this may be cut should be 14 x 18 inches, to accommodate the drawing papers 9 x 12 inches.

The children can be directed to do the folding and cutting necessary to make this simple portfolio.

Directions. Take the paper, 14x18 inches, or larger, if a larger portfolio is desired, and fold all edges down to make a 2-inch lap on all sides. Then fold the papers through the center, making a portfolio form. Cut the corners as indicated in the illustration. Cut also the angles from the ends of the center fold, and allow it to fold more easily. The portfolio should then be decorated. Ask the children if they would like to put a border of flowers or animals across the top, or use two only, as the illustration of animals in silhouette suggests. The rabbit or duck would be easiest for the first grade, while the squirrel, cat, bird or fishes would be more difficult. The third grade pupils might print the word *ART* in simple black letters. The flower units suggested on the same sheet could be used in a border, or a single unit might be placed on the cover of the portfolio. Try making the flower units in free brush strokes without a pattern. The animal form could first be cut and traced.

Use black, or mix red, yellow and blue together, making a tertiary color. This color will be harmonious with any colored paper used.

After the exhibition, let the children collect their work and place it in the portfolio to take home with them.

Test. Make a design appropriate for a stencil to use for a pillow top or curtains. Use appropriate colors.

Draw a design to show an appropriate decoration for a Christmas gift made by your pupils.

Write a brief outline of work done during June.

Exhibit. In connection with the closing exercises it will be a good plan to have an exhibit of the work of the year. You should begin to plan for the exhibit several weeks before the close of school so you may have time to classify and arrange the work to the best advantage. The exhibit should be ready at least a week before the close of school so that the pupils may have opportunity to enjoy it, and also to give parents especially interested, time to examine the work with care.

SUMMER GAMES
IN THE GYMNASIUM
EMG
LITTLE BOPEEP
DANCING

FIGURE DRAWING

50. A Source of Pleasure. The children will be delighted with some new figure drawing done simply in line work, showing games, gymnastic exercises and nursery rhymes. Interest them to observe children at play and work, and try to express action with simple line effects.

51. Trees. The pupils in primary grades should have very definite tree study, and after trying to express trees from pictures they should observe nature and try to express the trees they see daily. The teacher should show the pupils how to mass in effects on the board and then ask them to try the same effects, first in black crayon on paper, then on the board. After the tree in mass is expressed, the bare tree may be studied showing the two types; *excurrent*, where the trunk grows through the entire tree, branching along its side, such as the pine, poplar, etc.; and *deliquescent*, where the trunk subdivides into many branches, such as the apple, maple, elm, etc.

52. Design. If the teacher has never tried the valuable lessons derived by following simple line designs from the drawings on the board, she has an interesting experience in store. The teacher suggests by drawing and the pupils follow her suggestions by drawing, stick laying or tablet laying at their desks. These designs may be used as borders for book covers, or to decorate constructed objects where simple decoration may be employed. After a few exercises are given, arouse the children's interest to originate some new combinations in other designs. It is an interesting problem to use motifs especially appropriate for the object, designs suited to a booklet composed of spelling lessons, number work, nature study, etc.

53. Lettering. The making of book covers implies a use of good, simple lettering; and a plain block alphabet and numbers have been given to suggest simple lettering. Use straight lines as far as possible.

54. Toys. A new page of toys suggests blackboard treatment for this interesting theme. Ask the children to

bring their toys to school and draw from them, studying carefully first their form, proportions or mechanical contrivance. Memory drawings are always most excellent to develop the perceptive powers and stimulate the imagination.

55. Figure and Animal Drawings. The subjects most appealing to all children are found in the life about them. The animal world and the human activities are most vital to children. By stimulating their interest in caring for pets, studying their habits and trying to express their form, the clever teacher will increase the children's love and appreciation of all life.

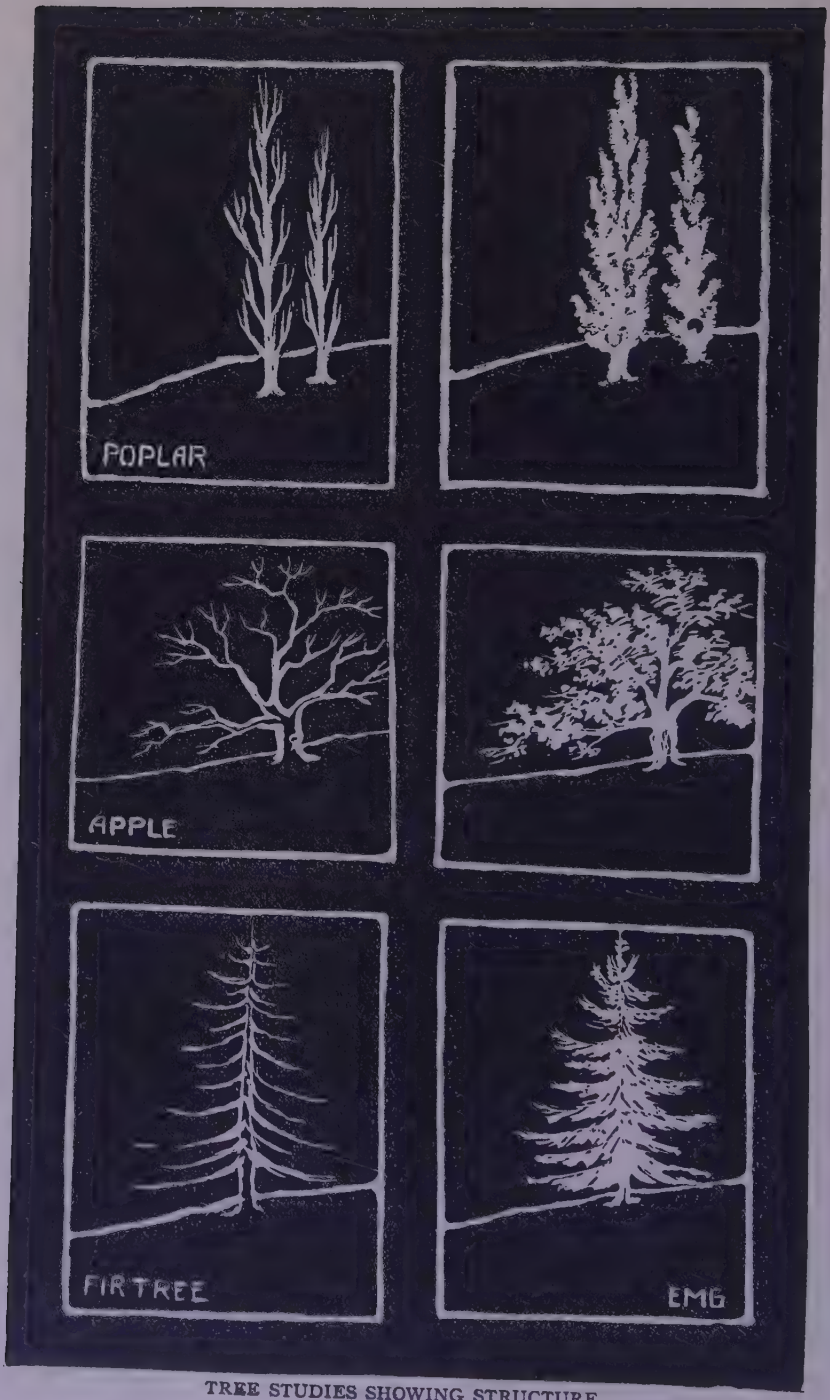
Studying the activities of mankind in all kinds of work and play, and putting forth the effort to express the story of human life, will assist in the growth of a humanitarian spirit. It is not only more skill of hand that is needed but also a directing spirit to use this skill daily for the good of humanity.

BLACKBOARD DRAWING

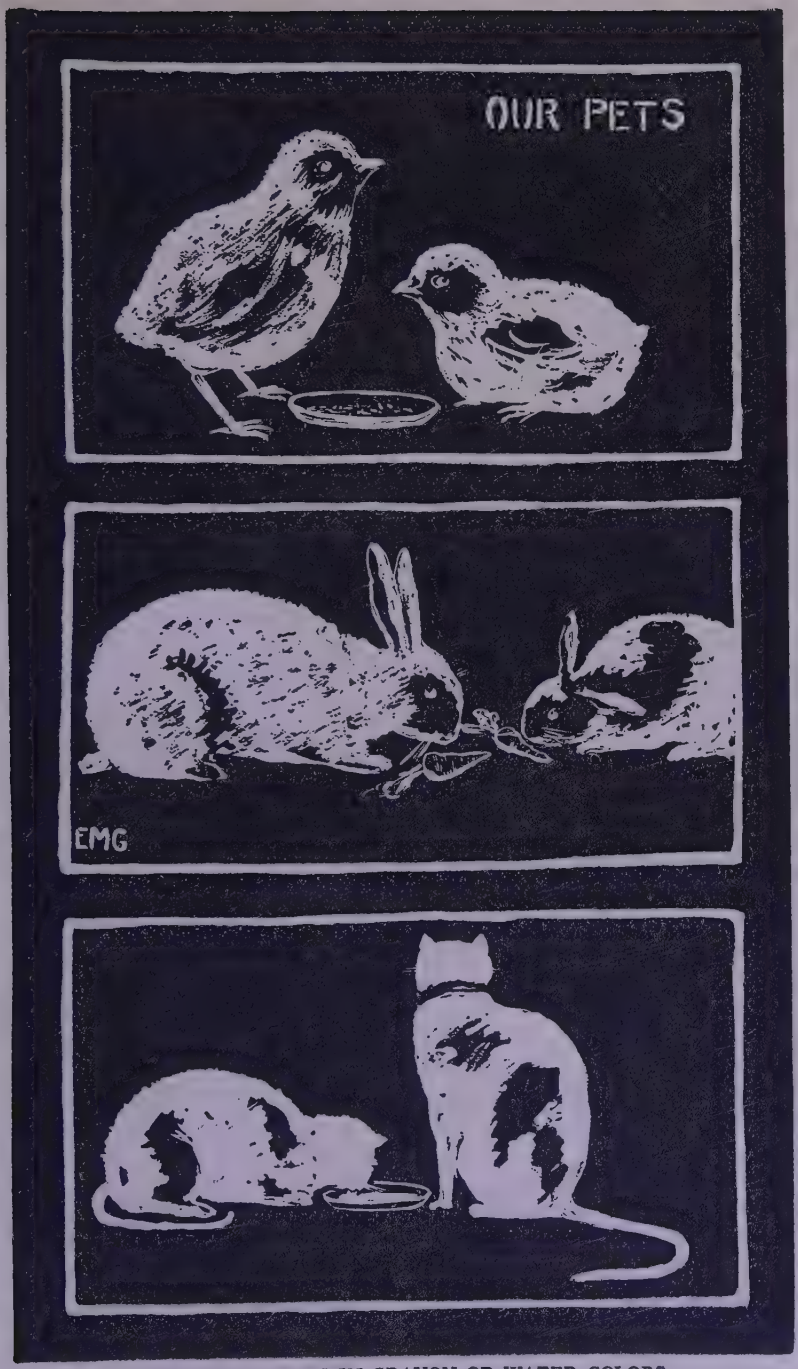
56. Value to the Teacher. When the psychologist affirms that the greater part of our education comes through the organ of sight, and that ideas are grasped much more easily when graphically illustrated than when merely described, he is also affirming at the same time that "drawing is the universal language" and is the greatest means of conveying ideas from one mind to another. If teachers were really convinced of this truth, they would put forth every effort to develop their ability along this line and use it hourly in demonstrating to their classes, making difficult problems easy, both for themselves and their students. A few minutes' daily practice would bring them unexpected results in ability to express form in quick blackboard sketching, and add immeasurably to the interest of the lesson.

The children are delighted with even a fair degree of success on the part of the teacher and are not half as critical as the teacher imagines. Especially is this true

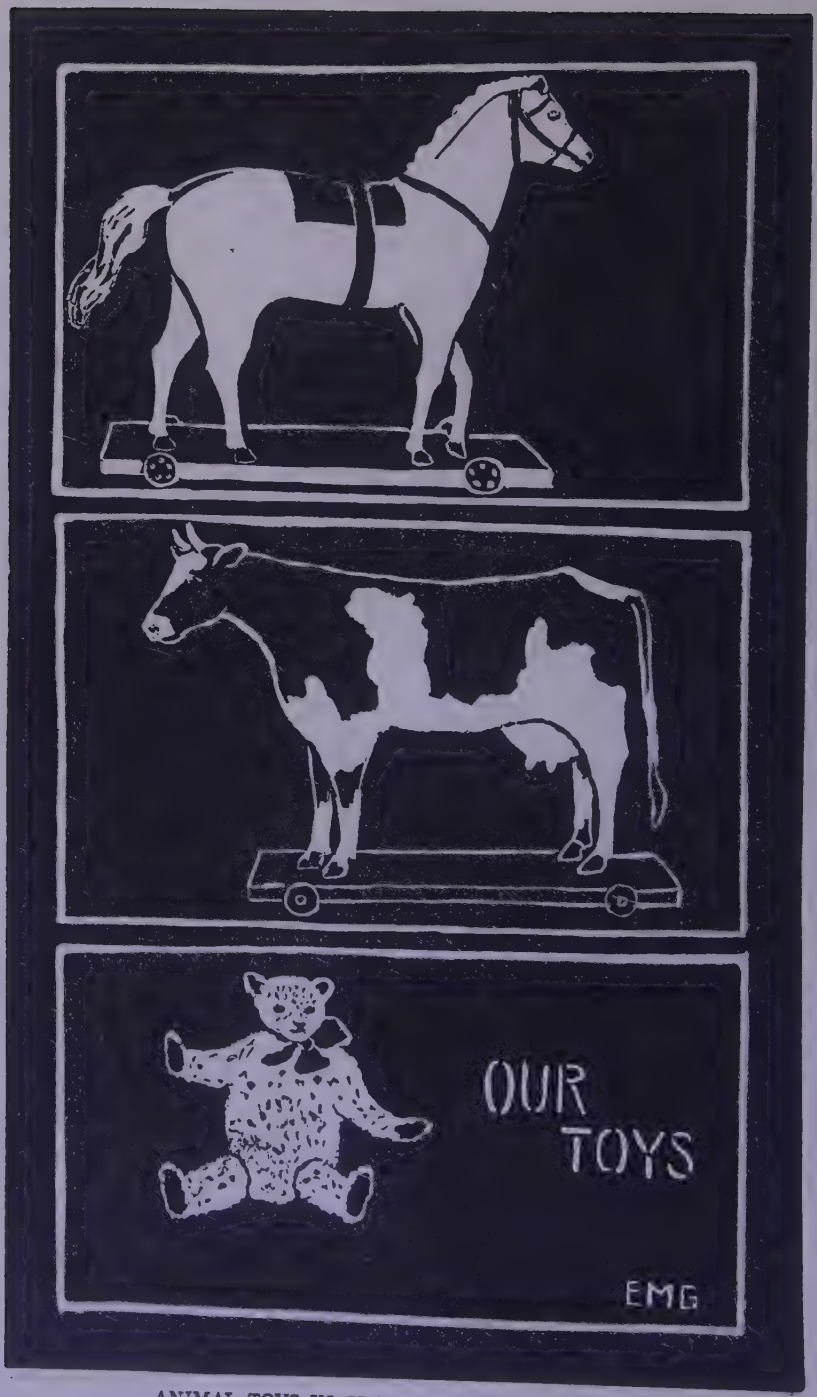
FIGURES SHOWING LINE STRUCTURE AND MASS



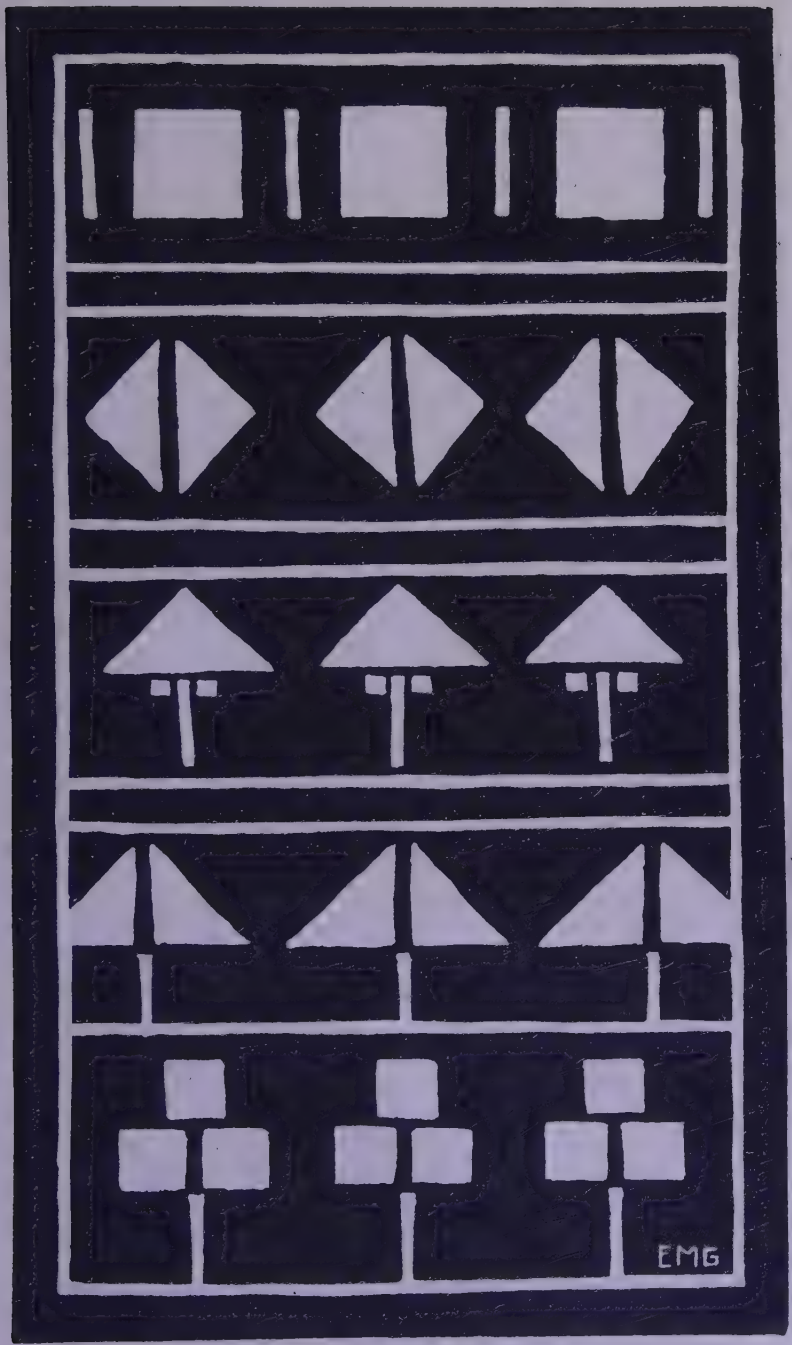
TREE STUDIES SHOWING STRUCTURE



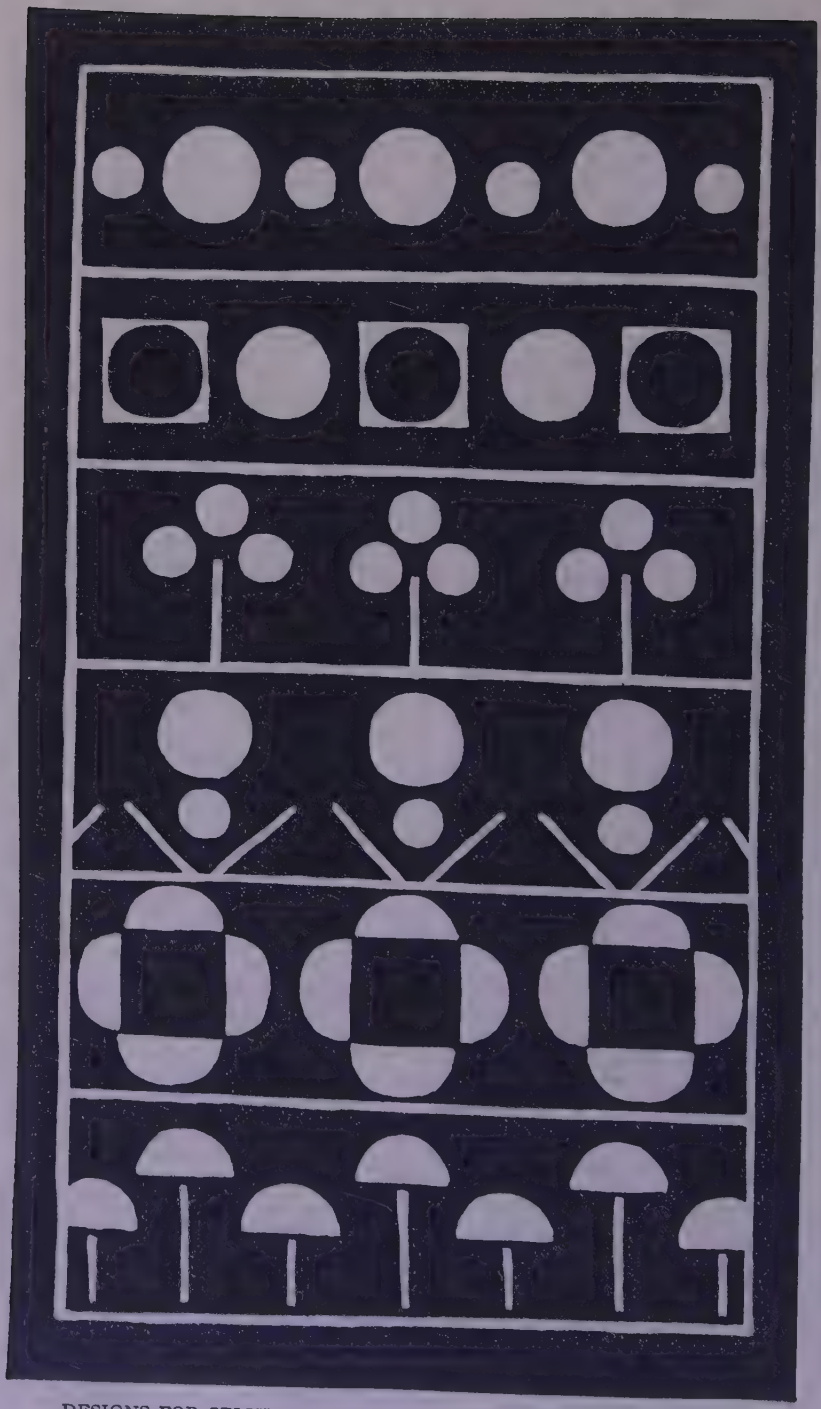
ANIMAL STUDIES IN CRAYON OR WATER COLORS



ANIMAL TOYS IN CRAYON OR WATER COLOR



DESIGNS FOR STICK PRINTING OR TABLET AND STICK LAYING



DESIGNS FOR STICK PRINTING OR TABLET AND STICK LAYING

CRAYON OR BRUSH WORK

when the teacher allows the pupils an opportunity to illustrate on the board as frequently as possible. This treat is most thoroughly enjoyed by the children, especially in the lower grades.

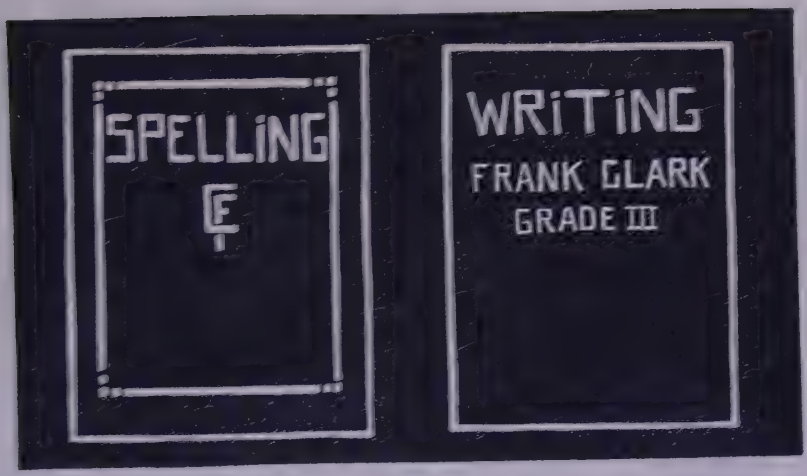
57. Method of Procedure. A clean board and soft crayon are two essentials for good work. If the crayon is the hard, dustless variety a great change may be made by putting the sticks of crayon in a hot oven and baking them. In using the crayon for drawing, always use the broad side of a piece, turning it around when different width lines are desired. By this method any width line may be secured.

Practice first on line drawing, merely to secure some technical skill. Stand as far away from the board as possible when working, in order to see the general effect. After sketching in lightly the general proportions of the study with a piece of crayon not larger than 2 inches in length, study the effect of the masses of light and dark. With the broad side of the crayon against the board put on a flat tone to represent the masses of light. The dark masses will be represented by the blackboard, unless it is desirable to make the effect still darker, in which case use charcoal.

When some skill is secured by the use of white crayon the teacher may use some colored crayon with discrimination. Even when colored crayon is used, it is well to make the first drawing with white crayon and then add the colored crayon lightly over it. Avoid having too many colors in one study.

58. The Blackboard Calendar. Besides the use of the blackboard for free illustration daily in connection with other studies, the school calendar affords an excellent opportunity to bring forth a symbolic study for each month. Commencing with September, when our interest is keen in the beautiful world of nature around us, select some simple flower, grasses or seed-pod from which to make a study.

The brown-eyed Susan was chosen as one of many, as



Designs for Booklet Covers

O sweet September, thy first breezes bring
The dry leaf's rustle and the squirrel's laughter,
The cool fresh air whence health and vigor spring
And promise of unwasting joy hereafter.

George Arnold.— *September Days.*

"WHEN THE FROST IS ON
THE PUMPKIN
AND THE FODDER IN THE
SHOCK". RILEY

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Fie upon thee, November: thou dost ape
The airs of thy young sisters . . . thou hast stolen
The witching smile of May to grace thy lip,
And April's rare capricious loveliness
Thou'rt trying to put on.— Julia R. C. Dorr.

it suggested the possibility of using colored crayon for the flower. Plan the space carefully that the flower composition, the printing and the calendar proper will occupy. It would be well to measure the spaces with a ruler. Sketch in the whole lightly with white crayon, using great care to make the printing, figures and flowers as perfect as possible. The study may be completed with white crayon, or yellow may be used for the petals of the flower with brown centers and green for the leaves. The spaces may be outlined with white or a double outline of white and brown around the rectangles. In planning the printing in a definite space, the number of letters should be counted and the space divided by vertical lines, giving equal space for each letter except the narrow letter *I* and the wide letters *M* and *W*. Use straight lines and make the plain block letters.

The calendar proper may be divided into spaces, and the letters for the days and figures accurately drawn in the spaces. It is helpful to start the figures at the end of the month where two figures fill the space. In this way the figures will not be too large, as they are liable to be if one commences with a single figure in a space.

(a) How to Secure the Correct Proportions. It would be well to use the same general proportions for the calendars on the board that you find in the studies. To secure these, measure the spaces in the study and use a multiple of these in the blackboard drawing. Use a yard stick on the board and measure everything so as to obtain the proper placing and proportion of each part. It is very helpful to draw small squares over the more difficult studies where animals or figures are used, and then draw to scale on the board, using squares of larger size, following the lines in the squares as suggested in the small spaces.

(b) Subject Matter. The calendars cover a wide range of subjects in flowers, landscapes, vegetables, figures, animals, fish, birds and marine views, from September to June, inclusive.

What was she like, the merry one
Blessed lady of New England's moon?
Where from was conjured all the free,
Dear holiness and the desert bird.
Judson.— The Tawny Beast of December.

December brings us weak, returning light
By our kind kinsman symbolized unarmed.
Now from the perfect circle of the year
Cast your Winter's crystal glass to marvel.
C. F. Tunnicliffe.— December.

Dearest maid, the meadow walk is sodden
Where we two ply and wend in hand,
Misty-breathing sweet her lowing cowmen
Plowmen shouting from the land.
Wise hands crooked, we with one mind
Pray join them makers of grand harvest
Glad to December say they all,
It gave to Bearn our Christ the Lord!
J. M. Hoyt.— The Meaning of the Months.

The Bunnies dance across the snow
In spite of chilling winds that blow

JANUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February makes a bridge,
and March breaks it.—Herbert

March. Its tree, Juniper. Its stone, bloodstone. Its motto, "Courage and strength in times of danger."—Old Saying.

"Sweet April showers
Do bring May flowers."
— Tusser.

EMG
BRINGING SEASONS WISHES
FROM OUT THE BRINY DEEP
MAY
SUN MON TUE WED THU FRI SAT
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31

JUNE
S M T W T F S
1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31

PICTURE STUDY

INTRODUCTION

59. Value. Picture study properly conducted will not only teach children to know and love beautiful pictures, but it will cultivate the power to discriminate among the most beautiful and the less beautiful and the ugly, and will lead them to banish ugliness from their lives. It will give them a never-failing source of refined pleasure and a continual inspiration. The interpretation of pictures by the pupils will often lighten the teacher's burdens.

60. Classification of Pictures. The first consideration in the proper method of picture study is the selection of pictures. Certain pictures are far better suited for children than others. A guiding principle is that we must consider the interests and capacity of the child. Children are unable to receive any message from many pictures which are enjoyed by adults. The capacity of the child permits him to appreciate pictures which deal with home and family life. His capacity and interest alike draw him to pictures which portray the *activities* of the life about him. For this reason, choose pictures that depict life in action, when possible. Pictures of animals, children at play or work, or a picture with story telling properties have been found to be most interesting to children in the primary grades, and even in the lower grammar grades.

61. Method. (a) STUDY OF THE PICTURE. (1) Let the children have an opportunity to enjoy the picture before much is said about it. Then ask them to tell a story about it in their own way, bringing out the *imaginative* side as well as the *facts* there portrayed. The teacher should learn any interesting subject matter about the picture or the artist.

From a painting by Raphael

MADONNA OF THE CHAIR

(2) Some information may be given the children in regard to what makes a good picture aside from its story telling or literary value. A picture should be *well-composed*, that is, fill the space well. In other words, the figures should not be too small, and the surrounding space too great when the figures are the important part of the picture. About two-thirds of the space may be occupied by the figures. The figures, if more than one, should form a *group* and not be scattered about the space, making too many points of interest. The figures should make an irregular form in the space to avoid the monotony of arrangement, that is, the heads should not be on the same line. This is avoided by placing some figures nearer the foreground than others. The most interesting figures should be placed centrally, never at the sides. You will notice in dramatic art that the hero or heroine usually stands at or near the center of the stage.

(3) After the story telling property of a picture is enjoyed by the children, the teacher should help them to appreciate some of the essentials that go into the making of a great masterpiece in art. There should be *simplicity*; a few objects brought forward and a crowded effect avoided. Second, there should be *harmony*, a common interest if there are several figures represented, and not a scattering of points of interest. Third, there should be contrasts to make an interesting picture, that is, a pleasing variety of dark and light masses or contrasts of color. On the other hand a picture should not present too many colors, as this distracts the eye. Fourth, the picture should be suited to the space which it is to occupy. If it is to hang in the schoolroom, choose a picture suited to the appreciation of the children.

(b) Hanging. In hanging pictures place them quite low within the children's range of vision. The center of the picture a little above the eye level is a good rule to observe. If necessary place it against the blackboard to make it low enough. Often a background of plain colored burlap

will add to the effect of the setting. This should be stretched against the background and tacked with a finishing braid or leather-headed tacks.

(c) FRAMING. Framing a picture suitably adds immensely to the proper effect. Choose simple broad frames of dark wood to harmonize with the picture. If the picture has much color a black frame would be in good taste.

(d) STUDY OF SURROUNDINGS. After seeing good pictures and knowing why they are good, it is well to open your eyes and enjoy the beautiful world about you. Try to see with the artist's eyes, and above all try to find beauty in the common things of life. Your home or garden or street might serve as an artist's model. There is so much for us to enjoy every day. Often the so-called commonplace is glorified when seen through an artist's eye. Whatever our work may be we may have visions of all the beauty that has ever come into our lives or into the lives of others through our study of pictures. Often we can forget the unpleasant in the memories of the beautiful. Let us remember that "A room full of pictures is a room full of thoughts."

STUDIES

62. Shoeing the Bay Mare, by the celebrated English animal painter, Edwin Landseer.

(a) THE PICTURE. Let us look at this picture and notice all the interesting things in it. A horse, a man, a donkey and a dog. What is the man doing? Did you ever visit a blacksmith shop and see the blacksmith put shoes on the horse's feet? He makes the shoes of iron to fit the curve of the horse's hoof. To bend the iron he makes it red hot in the forge and pounds it with a hammer on the anvil. Do you see one in the picture? He must have strong arms and a sure eye to mould the iron into just the right shape. The blacksmith wears a heavy leather apron and brings the horse's foot between his knees to nail the shoe on his hoof. The horse must be very glad

From a painting by Landseer

SHOEING THE BAY MARE

to have the sharp iron shoes on when the roads are slippery, for they help to prevent him from falling.

This picture was painted for an intimate friend of Landseer's, Mr. Jacob Bell, who was doubtless very proud of his fine, high-bred mare, Betty, who it is said would walk to the shop unattended to be shod. Here she stands without halter or bridle and looks around very intelligently at the work going on. The mare, with her sleek coat, looks every inch the high spirited horse that one sees in England, for the Englishman is fond of fine horses and treats them very kindly.

The patient little donkey stands under Betty's fine arched neck. The dog is a bloodhound named Laura, and she, like the donkey and Betty, is looking at the shoeing process. All interest centers in the blacksmith. His work is very important and we could not get along without him. The horse would be a fine one to try to draw. It is difficult to make a good drawing of a horse, but Landseer has given us here a fine example.

(b) The Artist. Would you like to know something of this artist? A hundred years ago there lived in the great city of London a little boy named Edwin Landseer. His father and mother were great lovers of the beautiful in nature and art and encouraged their children in every way to develop their artistic talents. His father was a well-known engraver and his brother Thomas distinguished himself in the same profession. As soon as he could hold a pencil, the boy Edwin began to draw. A drawing of a foxhound made when he was five years old is still exhibited as a remarkable production.

Edwin and his two brothers would often go with their father to the open fields on the outskirts of London to a place called Hampstead Heath. Here they could see cows, sheep, goats and donkeys grazing, and the father would assist the boys in making sketches from life, and they would proudly take them home for the mother and sisters to enjoy. Sometimes the father would take the children

to the Zoological gardens where they could see many wild animals and make sketches from the lions and tigers to take home as trophies of their visit.

From a boy, he was both industrious and successful. He won many medals. His first picture was exhibited in the Royal Academy when he was but thirteen years of age, and for nearly fifty years his work appeared at nearly every exhibition. He made his home with his sister in St. John's Wood, just out of London. Here he kept his pets and filled his studio with their pictures, and here he entertained the brilliant men and women of his day. Landseer never married. Among the ladies whom he admired was Rosa Bonheur, and he always spoke of her as "The poet-painter of animals." He was once elected President of the Royal Academy, but he declined the honor. As he grew older he would sometimes speak of "his worn-out old pencil." He died in 1873 at the age of seventy-one and was buried at St. Paul's Cathedral, London.

63. Feeding Her Birds, by Jean Francois Millet.

(a) The Picture. Let us look quietly at this interesting picture and then some child may tell what he sees in it. Three little children are sitting in a doorstep receiving lunch from their mother, who is feeding them from a bowl. It is the home of the artist who painted it, Jean Francois Millet, the French painter. The children are three of the nine Millet children. Notice how the children are dressed. Do you see their wooden shoes, called *sabots* (pronounced *sa bō*)? The cloth in their dresses was doubtless made in the home, the thread spun from flax grown in the fields or perhaps of wool from the sheep, woven into cloth and made by their mother into simple little dresses. They all have caps on their heads. What has the oldest child in her lap? It looks like a doll. Why is the picture called *Feeding Her Birds*? Do they not look as if they were cuddled together in a nest?

(b) The Artist. The home is a very simple one of few rooms and very little furniture, for Millet was a poor

From the painting by Millet

FEEDING HER BIRDS

man although so talented in his art. They lived in the little village of Barbizon, about thirty miles south of Paris, at the edge of the beautiful forest of Fontainebleau. Here lived a number of great artists who loved the country life away from the noisy city. This picture is said to have been a great favorite of Millet. If you can see the picture plainly you will notice the father at work in the garden just behind the house. The children have only a few simple home-made toys with which to play. Can you see any of their toys in the picture?

Could you find a pretty little scene around your home that would make a pretty picture? Millet was very fond of making pictures of the peasants who were busy at their work. He was born on a little farm near the town of Gruchy on the north shore of France. His parents were poor, but very proud of the young man's talents. He studied art in the seaport town of Cherburg and received help from that city to continue his studies in the great city of Paris. He studied there several years, but his greatest pictures were painted in the country. He is called the "Painter of Peasants." Some of his other great pictures are *The Gleaners*; *The Angelus*; *Sower*; *Feeding Her Chickens*; *The First Step*; *Churning*.

Although the people of his time did not appreciate his pictures, they are now considered priceless. Many are owned by the French government.

64. Madonna of the Chair, by Raphael.

(a) The Picture. Every one loves this beautiful picture of a young mother with the dear little baby. It was painted to represent the child Jesus and his mother. The little boy by their side looking up at them represents Saint John. It was painted by the much loved artist Raphael, who lived in Italy in the early part of the sixteenth century. Did you ever hear the story of how it happened to be painted? Raphael was walking out from the city of Rome one day, looking for interesting subjects to paint. Passing a certain modest home, he saw a very

beautiful young mother sitting with her baby in her lap out in the garden. He asked for permission to make a sketch of her, and noticing the head of a barrel near by he picked it up and used it upon which to make the sketch.

In conversation with the young mother Raphael learned something of her life story. She was so impressed with the high office of posing for a Madonna picture that she thought it was in fulfillment of a blessing wished for her by a good old hermit, called Father Bernardo, who lived near her father's home in the Italian hills. She often took him presents. One time a dreadful storm swept away his home and he sought refuge in an old oak tree. When Mary arrived he had been three days without food and was half-dead from exposure to the cold and rain. She took him home with her and cared for him until his home could be rebuilt. He used to pray that both Mary and the oak tree should be blessed for saving his life. The old oak was cut down and made into barrels, for Mary's father was a vine dresser and made wines, and so it came to pass that the oak tree furnished the circle of wood for the portrait of Mary and her children to be painted upon. Certainly the good old hermit's prayer was realized; both Mary and the oak tree have been immortalized. The original painting is beautiful in color. The Italian women are fond of stripes of gay colors, so the shawl and scarf on her head represent all colors of the rainbow. The baby is held very close in his mother's arms. The little brother has a cross in his arms, faintly seen. This is always the symbol that St. John bears. The circle of light around the mother's head suggests her divinity. It is called a halo or a nimbus.

(b) The Artist. Raphael's name was taken from the name of an angel mentioned in the Bible. Little did his parents dream that his name should be known as "Raphael the Divine." Raphael's father was an artist and a poet, and his mother a very good and beautiful woman. As a little boy he spent a great deal of time in the studio of his father, who commenced to teach him at an early age.

From a painting by Van Dyck

CHILDREN OF CHARLES I

His mother and father died when Raphael was still a lad and he was left in the care of an uncle. He studied under the artist Pemgino, who loved Raphael as a son. He soon excelled his teacher. Subjects from the Bible were his favorite themes for his pictures. He painted many Madonna pictures, and received many orders for pictures from the Pope in Rome for the Catholic Church, and also for his home, which is called the *Vatican*, and is near St. Peter's Church. Raphael was a great worker and was much loved by all who knew him. He was only thirty-seven years of age when he was taken ill with a fever and died on his birthday, Good Friday, in 1520. All Rome mourned his death. A long procession followed his body from his studio to the tomb in the Pantheon. One of his pictures, the last one he painted, representing Christ ascending into the sky, was carried in the procession with the colors still wet.

65. Children of Charles I, by Anthony Van Dyck.

(a) The Picture. About 300 years ago the children represented in this picture lived in London, England. They were the children of the King and Queen of England. The oldest boy is called Charles, Prince of Wales, in honor of his father who was Charles I. The daughter is called Princess Mary, and the youngest one is James, afterwards called the Duke of York, and who eventually became King James. The children are dressed as are their elders, in very rich and elaborate gowns. They look as if they were dressed up to have their portraits painted. They do not look as if they could have a good time and play in such dresses. Their portraits were painted by the famous Flemish artist, Anthony Van Dyck who was invited over to England from Antwerp to paint portraits for the king and the court. He painted many pictures of the children; some of them are to be seen in London, others are in Germany and one even down in Turin, Italy.

The children were often painted with their pet dogs. What kind of a dog is represented in this picture? I think

it is a hound. Would you like to have your picture taken with a pet? Perhaps you could make a picture of your pet dog or cat or collect pictures of pets and make a scrap book of them.

(b) The Artist. The artist Van Dyck showed great talent for drawing even as a young boy, and commenced early to take lessons in art. His father was a silk merchant in Antwerp and his mother was skilled in embroidery. He was the seventh in a family of twelve children. He studied under the great painter Rubens and finally equalled or surpassed his master. The story is told that when he and a group of art students were in Rubens' studio one evening, they accidentally injured a portrait that was freshly painted. Van Dyck was chosen to retouch it, and he did it so cleverly that Rubens recognized the work of a genius, and instead of scolding him, gave him great praise for his skill.

Rubens advised him to go to Italy to continue his art studies and here he made many friends and had many portraits to paint. Upon his return home after spending five years in Italy, he was invited to England by the king, and here he lived in royal style and painted many pictures of the king and his family and the court. He married an English woman in London, and had one daughter. Van Dyck died at the age of forty-two. He left a large collection of his works, and is acknowledged as one of the great portrait painters of his day.

66. A Helping Hand, by Emile Renouf.

(a) The Picture. Did you ever have a ride in a boat? What kind of a boat is shown in the picture? In what country do you think these people live? Can you tell from their dress? Notice the dress of the old man, the sailor's rubber hat, heavy warm clothing and wooden shoes. The little girl looks somewhat frightened as she sits and clings to the large oar, but she wants to help, as the name of the picture implies. I think her grandfather is pleased to have her with him. Where do you think they are going? Do

From a painting by Emile Renouf

THE HELPING HAND

you see the fish net in the farther end of the boat? Do you see the mast and the sail in the fore part of the boat? Where is the horizon line? Do you see any boats in the far distance? Is the boat near the shore? Do you see the rocks at the left of the picture? A picture of the sea is called a *marine*. What kind of a day is it? Can you tell from the sea? Could you imagine the color of the sky and sea? Could you try to paint a marine with your water colors? Put a wash of clear water on first, than a light blue for the sky and a green blue for the water. The figures would be too difficult to try as yet.

(b) The Artist. The artist who painted this picture was born in Paris, France, in 1845. His name was Emile Renouf. He came to the United States at one time and painted a picture of Brooklyn bridge in New York City. It is in a French art museum. He received many medals for his fine works of art. He died in Havre, France, in 1894.

(c) Boat Pictures. Would you like to make a collection of boat pictures to learn the different kinds of boats? Besides a row boat you could have a sail boat, a canoe, a yacht, a steamer, a viking boat, a tug boat, a ferry boat and different boats used in the navy. Perhaps you could draw different kinds of boats, and even make some toy boats to sail on the pond. Do you know the names of some of the great historic boats? Do you know the kind and names of the boats that Columbus sailed in to the new world?

What was the name of the boat that brought the Puritans from England? What kind of a boat was the Mayflower? Could you make a picture of it? Did you ever see the picture of the famous English boat that fought against the Spanish Armada? The artist Turner made a beautiful picture of it, as it was being taken out to sea by a tug boat to be buried when it became useless. It is called *The Fighting Temeraire*. A beautiful sunset completes the vision. If you have a kodak it would be fine for you to

try to take some snap shots of the pretty places near your home. The water effects are always very much enjoyed. Try to get a boat or trees in the picture or some figures to pose for you.

67. Penn's Treaty with the Indians, by Benjamin West.

(a) The Picture. An example of the story telling picture is shown in Benjamin West's *Penn's Treaty with the Indians*. It illustrates an important event in early American history. As a result of this treaty the Quakers and Indians formed a compact of friendship that was never broken. "Not a drop of Quaker blood was shed by an Indian." William Penn, the founder of the state of Pennsylvania was born in London in 1644. While attending Christ Church, Oxford, he accepted Quaker views, which caused his expulsion from the University and led his father to adopt harsh measures against him. In 1668 Penn became a leader among the Quakers, and on account of an essay entitled, "The Sandy Foundation Shaker," was imprisoned in the London Tower for seven months. During this time, he wrote some of his most important works. The persecutions of the Dissenters continuing to rage, Penn turned his thoughts toward the New World.

From his father he inherited a claim upon the government of $80,000, and in settlement of this claim the government in 1681 granted him large territories in North America, including the present state of Pennsylvania. Penn came to America and laid the foundations of his colony on a more free and democratic basis than had at that time been allowed in the world. His dealings with everyone, including the Indians, were always most upright and honorable.

(b) The Artist. Benjamin West, one of the early American artists, has shown in this picture Penn in the center of a group of Quakers and Indians in the act of making a treaty. The Quakers are dressed in their characteristic costume of long coat, knee breeches and three-cornered hat over their long hair, making a strong contrast

PENN'S TREATY WITH THE INDIANS

to the Indians in blankets and feathers. Where do you think the scene is laid? The surroundings suggest that it was the colony of Philadelphia. What river is represented in the picture? The forest primeval is shown in the background and various groups around the central one depict the youth of each people. What is the Indian baby called? Did you ever see a cradle like that? The story is told that the artist, West, was given his first instruction in color work by the Indians in Pennsylvania. It is said he used colors from different vegetables and how do you suppose he made his brushes? He was supposed to make them from the hair cut from a cat's tail.

He was a very talented boy in art, and when quite young made a very good portrait of his baby sister as she lay asleep in her cradle. He left at an early age for England where he studied art and became very successful in painting portraits, pictures of historical and Biblical characters. He became a close friend of the king of England, for whom he painted many pictures. A large number of his pictures are in the London National Gallery, and also in the Philadelphia Academy of Fine Arts. His success was so extraordinary that it fired the ambition of many a young American painter.

His native town of Philadelphia was the first to afford opportunity to the young men who wished to study art. West's pictures tell about an interesting period in American history, but they are not considered the best examples of art in color or composition. His pictures are often too crowded with figures and the colors are too bright to be natural, which is true in this picture.

CHAPTER FIVE

SPELLING

1. What Spelling Includes. The ordinary definition for spelling is, "Naming or writing the letters of a word in their proper order." This, however, is far from a complete definition, when the teacher sees the mental processes involved in good spelling. Spelling is more complex than a mere memory exercise upon letters in a given order. Perception, imagination, concentrated attention and general intelligence are all needed. Many repetitions are necessary.

Perception of forms, similar and dissimilar, nearly alike and wholly unlike, as wholes or in parts, must be established as the first step in spelling, for spelling is quite largely a matter of *seeing forms* with absolute accuracy.

The above statements apply particularly to written spelling. To aid a child to become an expert in oral spelling, in addition to the eye-training (visualization) there must also be definite training of the ear, to enable it to perceive and distinguish between sounds with the same accuracy as that with which the eye recognizes resemblances and differences of forms.

Those pupils who are naturally dreamy, who do not see or hear quickly the things that are going on around them because "their wits are wool-gathering," are almost certain to be poor spellers. On the contrary, those children whose perceptive powers are always alert, whose powers of attention and retention are good, are nearly always good spellers.

The exceptions are due to lack of interest or to inability to picture the word mentally.

2. Preparatory Work. Spelling is too often imposed upon children in such a way that they feel it to be a mere task, the usefulness of which they are unable to see. When the work is presented in this manner, poor results are sure to follow. The teacher should always bear in mind that spelling is a mode of expression. The child cannot express his thought in writing until he knows how to spell the words he wishes to use. When he feels the need of spelling as an aid to expression, he is ready to incur the labor necessary to acquire the art. In the first and second grades, then, reading, spelling and writing are so closely related that there should be no attempt to separate them. The child's first spelling lesson occurs when he is first asked to write a word or sentence used in his reading lesson. (See Volume One, page 98, Subsection b.)

Again, all exercises which aid in developing the powers of observation are aids to spelling. This applies especially to those lessons which promote accurate visualization. Every word learned as a whole from blackboard, chart or book; every word built with splints, pegs, lentils or alphabets; every word copied with crayon or pencil on blackboard, slate or paper; every word properly pronounced, and every word learned from the recognization of its syllables—all these, though not spoken of as lessons in spelling, are really elementary phases of this subject.

3. Oral and Written Spelling. During the first half of the first year, all of the spelling exercises are incidental and written. They consist first in copying words and sentences written upon the blackboard by the teacher, or presented to the class in some other written or printed form. The second step consists in writing these words and sentences from memory. The child must obtain a correct image of the form of the word before he can reproduce it in writing. This makes spelling in the primary grade purely a form study.

Oral spelling may be introduced gradually in the second

half of the first year, and oral lessons can be increased in frequency until in the third grade pupils may be required to spell all new words orally, as well as write them. Oral spelling is of value chiefly for the reasons that it aids in pronunciation and it adds the sound of the word to its visual form. Ear-minded children learn to spell orally with less effort than by writing, while children who are strongly eye-minded are probably assisted but very little by oral spelling. In practical life, the amount of written spelling exacted from the individual is much greater than the amount of oral spelling.

4. The First Lessons. When the child first begins to copy the words that the teacher writes upon the blackboard, his effort is given to reproducing the form, and his attention should be fixed upon the word as a whole. He has not arrived at the stage where he can analyze the word, that is, separate it into its letters. At first nothing should be said about letters. If the child is not able to reproduce the form, erase his work and ask him to look at the word and try again. Do not call his attention to the mistakes he has made; this only impresses the wrong form upon his mind, when it is the correct form that we wish him to remember. By strictly adhering to this plan, the teacher soon leads the pupils to study the forms of words carefully, and this is of the greatest importance in making a good beginning in spelling. If primary teachers generally would follow this simple plan, much of the time and energy would be saved which is now wasted in teaching first grade pupils to spell, and at the same time better results would be secured.

When the pupils have become accustomed to reproducing word forms, attention may be called to the letters. This should be done incidentally, as the teacher assists the children in writing the words and sentences. She may say, "Mary, your *w* is too large; James, you have made an *n* for a *u*; look at the word on the board and see how it is written," and so on, as she goes from pupil to pupil. Oral spelling introduces a complete analysis of the word by letter.

In the first three grades all spelling lessons should be related to the lessons in other branches, from which the words should be taken. No spelling book is needed in these grades, and unless forced upon the children by the course of study, it should not be introduced.

5. How Much to Spell. Some superintendents require a maximum of one hundred words as the work of the first year classes in spelling. These words are chosen chiefly from the reader in regular use, and the children are required to write these correctly from dictation and to spell them orally, as well. Other superintendents make a demand of two new words daily for the first term, three for the second and four for the third, leaving one day of the week for a review exercise.

For teachers of little or no experience, a definite assignment of work by superintendents or principals is fortunate, since it prevents the mistake of trying to accomplish more than can possibly be done well. Teachers of mature experience say little or nothing about spelling during the first term, knowing that time must be allowed for the children to learn letter names and letter forms and the ready recognition of word forms.

For the first term, then, let the oral spelling lessons be held in abeyance, and written spelling be emphasized by frequent exercises in visualization and by having classes build words and copy words, with the written copy always before them.

Oral spelling, as such, may begin with the second term. By that time, the class has a small written vocabulary definitely established as a part of its usable school material. From this select at first the words for the oral work that have become most familiar. The class will be pleased by promotion to the dignity of sharing the formal written spelling exercise with the pupils of the second and third grades.

6. Plan for Written Spelling. At a given signal, all desks are cleared of books and all other materials. Spelling slips and pencils are quickly distributed by helpers. Each child writes his name at the top of his spelling slip. The

teacher takes her place in front of the first grade, says "Ready," and requires every pupil's eyes to meet her own. Then she pronounces clearly and carefully, *once* only, a word, requiring the class in concert to pronounce the same word before any one begins to write it. The teacher now passes to the front of the second grade and proceeds as before, giving a word from the lesson for the second grade. In a similar way she pronounces for the third grade; then again for the first grade, and so on. When all the words are written, helpers collect the slips and pencils.[1]

For the second and third grades, lists of words are chosen as before from the other subjects taught in those grades. Not more than four new words daily should be required at the beginning of the second year, but the number may be increased in the daily lesson to ten words by the addition of six words from review lessons. The new words may be increased to five for the third term of the second year. Once each week oral spelling may be given for review, and once a month for a general review of all words previously taught.

Begin the third year with six new words, reviewing four, for the daily lesson. Give an oral review once each week, and a general monthly review as before. During the year, gradually increase the number until the class learns ten new words and reviews ten in the daily lesson. This is the maximum for the last of the year.

Cautions. (1) In assigning the lesson, great care should be taken to use such words as will require about the same time and effort from day to day.

---

[1] The plan of collecting pencils is peculiarly unhygienic unless conducted in a proper manner. To collect all the pencils in a box and allow any child to take any pencil therefrom is a frequent source of the spread of disease. To obviate objections to the collection of pencils, the following simple plan may be followed: Procure for each row of seats a block of wood about the size of a brick, and have bored in it as many holes of the right size to hold each a pencil as there are seats. Each pencil may be easily marked by cutting a sliver from the unsharpened end and printing on the cut surface of the pencil an initial letter. As helpers pass the block around each pupil stands his pencil upright in the hole which corresponds to his seat. When not in use the blocks stand upon the teacher's desk. The helpers can distribute the pencils very quickly by passing down the aisles and allowing each child to take his own pencil from the block.

(2) Guard those who are naturally deficient in the qualities that are needed to make good spellers from thinking that they cannot learn to spell. They must be made to believe that they can spell, their interest must be aroused by varied devices and other lessons in visualization must be strengthened by much repetition.

7. Deficient Children. For children who are weak in the power to image a word as a whole, or to retain the image after it has been given, spelling lists of disconnected words is cruelly hard and of very little value. Such pupils should be encouraged to spell more frequently than others of the class by calling upon them to spell all or nearly all of the words in the general lessons that the teacher wishes to write upon the board. They should also be asked to write short sentences formed and dictated by the teacher from the words of the lessons. These two plans bring the law of association to aid the memory, while in spelling from lists memory is aided by repetition only. To give these children the exact meaning of the words to be spelled, brings again the law of association to strengthen the power of retention.

Oftentimes the whole trouble of the poor spellers comes from lack of full attention. Study the pupils, note the attitude of the body, the expression of the face, the look in the eyes. Then see that the poor spellers are made wide awake in every sense, and keep them so by requiring answers so often that while the lesson lasts they have no chance to become listless or lethargic. All this must be managed with great tact in order not to have their classmates notice that these children are doing most of the work in spelling. In other classes, keep them alert, but do not require them to do more than their fair share of work in subjects which they understand and prepare as well as their classmates. Commend their successes, particularly in spelling.

Encourage and stimulate effort by explaining how essential good spelling is. Even the poorest laborer needs to know how to spell when he writes a letter to his friends, or orders his coal and groceries. Also explain how much

more easily a person gets a good position in a business house when he can spell his words correctly, knows how to use capitals and punctuation marks intelligently and has a neat, legible and rapid handwriting. By such means stimulate ambition and at the same time show the close association between language, penmanship and spelling in their application to the practical needs of life. Of one thing we may all be sure. These pupils will never become accurate spellers until interest and ambition are fully aroused and the right methods of work become fixed habits.

8. How to Study Spelling Lessons. There is little doubt that more time is wasted over spelling than over any other subject. Pupils are allowed too long a time for study. Teachers, too, often fail to indicate the words that need the most time, so the children give as much time to the study of *ant* as they do to *gnat*; as much to *new* as *knew* or *gnu*; as much to *men* as to *people*, etc.

Attention during the study period should be keen, impressions vivid, and effort concentrated upon that which is really difficult. As a rule, however, the children are hastily told to "study these words twenty times; then write them twenty times, each; then put each word into a sentence." Perhaps a part of the words really need but one good, keen look to fix their images in the memory; others need all that has been asked and, possibly, a great deal more, in order to get the perplexing combination of letters accurately and permanently placed.

Again, the teacher simply points to the list of words and says, "Study your spelling till time to recite," when that time is, perhaps, forty minutes later. The children know they have a long time and a short list of words; hence, they dream away the long minutes, putting no mental effort into the so-called studying and getting less benefit out of forty minutes than they should gain from ten minutes of brisk work with every faculty alert and attention at its best. The teacher who is responsible for such a waste of time deserves severe censure for gross ignorance of the fundamental laws of

teaching, when every educational paper of the present day is teeming with suggestions leading to rational methods of study and recitation.

Suppose, then, twenty minutes each day are allowed for the formal spelling lesson. Use the first fifteen for having the words written, as before explained; the papers corrected; sentences, each of which contains some word from the list, given orally and written upon the board; attention called to the use of capitals and marks of punctuation in these sentences; errors corrected therein by recalling what has been taught incidentally in the reading lessons. Vary the written lessons at times by using slates and blackboard instead of spelling papers.

Use the last five minutes for the preparation of the next lesson, showing the class how to study it. From the new words found earlier in the day in the reading lesson, sense-training or nature study, select one by one until the required number is reached. Write each word clearly and distinctly upon the board, separating the syllables by a little space and placing the accent mark in the proper place. Pronounce each word and have the class pronounce it in concert. Call attention to silent letters, compound words, possessive mark and capitals, if any occur, and call for the meanings of doubtful words. If there should be *John's* in the lesson, caution the class to be careful about the apostrophe and the capital letter. When the word is spelled orally, require the class to pronounce the word, and spell it as, "Capital J-o-h-n-apostrophe-s," naming the capital and the apostrophe. In a compound word, the hyphen should always be written and should be named until the habit of writing is so firmly fixed as to render the naming unnecessary.

Cautions. (1) Train pupils to capitalize no words in lists except those that are commenced with capitals in all cases.

(2) Follow the same rule for use of the hyphen, apostrophe, etc. After all the words are written, have the class pronounce and spell orally, as follows: "hat'ter (pause) h-a-t (pause) t-e-r, hatter." This plan teaches syllabication, and

pupils learn unconsciously and easily where to separate a word at the end of a line when that becomes necessary. It also insures clearer enunciation, correct pronunciation, and prevents errors in spelling due to misunderstanding the word.

(3) Call attention to difficulties, thus: "You need to be very careful about these words. Notice the silent *k* in *knew*, and the silent *g* in *gnat* and the *apostrophe* here in *John's*."

After five minutes of this kind of work, briskly done, not more than ten minutes of study will be needed to master any lesson likely to be given.

(4) In case only ten minutes, or fifteen, at the most, can be secured for the spelling recitation, see that this preparatory treatment is given when the words occur in the reading or other lessons.

(5) No child should be trusted to study his spelling lesson without this preparatory help, since he is liable to see incorrectly or to miscall the words, and then go on repeating his mistakes all through his study period.

9. Visualization. At some time during each day, have a very brief exercise in the visualization of words. Get attention, write a word, and, after a moment, erase and ask the class to name it. It is better not to continue this exercise more than two minutes with the first grade children, because it demands intensity of attention, and the erasing is done so quickly that the strain to the eye is severe from the instantaneous and repeated change of focus required.

Frequently vary this drill by substituting objects for words. Show the object, instantly remove or cover it and call on the class to name it. Also train the pupils to look at a new word, close the eyes or look away and instantly tell if they can see the word with their eyes shut. While their eyes are still closed apply such a test as the following:

"What letter do you see first?" "What is the next letter?" "The next?" and so on till all are named. Suppose the word is *John*, and the first child says he sees *j-o-h-n*. When he is done, the teacher asks, "Do you all see it as

Fred saw it?" One child replies, "I saw a *capital j* first." The teacher may say, "Yes, that's what I saw. Now let us look at the word and see just how it is." Or she may say, "What do you think about it, Fred? Should there be a capital *j* or small *j* there?" Fred will probably agree with the correction and in that case should be asked "Why?" If he really knows his lesson, he will be able to say, "There should be a capital *j* because *John* is a boy's name."

10. Value of the Imaging Power. This drill in imaging will help any child to learn to spell more rapidly than any other one exercise we have ever tested, and it is particularly helpful to the "backward" speller of any grade. This visualization is the quickest test for written spelling and is what most people rely upon when obliged to pass judgment upon the written work of themselves or others.

11. The Law of Association. In the primary grades, help the pupils by giving or illustrating the meaning of all the words they have to spell. Help them, too, by having many lessons consisting of words that fall into natural groups, as the names of the parts of a plant. For example, *sunflower*, *blossom*, *leaves*, *stalk*, *seeds*, *roots*, *large*, *yellow*, *broad*, *green*, *tall*, *rough*, *hairy*, *brown*, *many*, *hardy*, *strong*. Again, the lesson may be based upon units of liquid or dry measure, as *gill*, *pint*, *quart*, *gallon; pint*, *quart*, *peck*, *bushel*.

Familiar things to eat or drink; articles of clothing for children, for men and for women; articles of furniture for the kitchen, the dining room, the sleeping room and the parlor; names of vehicles; names of domestic animals; groceries to be ordered for breakfast, for dinner or for supper; fruits; meats; names of common diseases—all these subjects will furnish valuable material for many lists.

Children who have had their perceptive powers well trained learn to spell many things from posters and other advertisements. We recall giving a second grade class an interesting story that contained the names of many wild animals, such as elephant, leopard, tiger, rhinoceros and monkey. We were certain that the children had never

before met such words in a reading lesson. After a brief inspection of the story a delighted smile passed over the faces of many in the class and to our astonishment the children read the long, difficult paragraph with ease and much evident satisfaction. Upon inquiry, we found that they had learned these words from the circus bills then adorning all available vacant space in town.

12. Spelling and Drawing. To lend fresh interest to the study of spelling, have the children make outline drawings of the objects for which the given words stand. Such an exercise as this may be given in three ways, viz.: (1) The teacher draws the outline forms upon the blackboard, and writes the name clearly under each. The children then study and copy both drawing and name with the teacher's work in plain sight. (2) The teacher places the outlines upon the board, but writes no words. The children copy the outlines and supply the needed words. (3) The teacher writes the words only. The children copy the words and supply the drawings.

After a set of words, four or five in number, has been given in these three ways, a review of the lesson may be called for, in which the children are told to write the list of words from memory and supply the proper drawings without any copy.

13. Spelling in Sentences. In the first year, have the children copy a good many short sentences with alphabets, pencil and crayon. Occasionally have a short sentence written from dictation. Also have children copy quotations they have memorized, stanzas of easy poetry, directions for calling classes, etc. The thought is a great aid to the spelling.

During the second year, continue this copying and dictation, but extend the work to include longer sentences and entire paragraphs. In the third grade, the children will be glad to copy entire poems, fables, proverbs or other selections from blackboard and books. They will also take great pride in writing much longer exercises from dictation.

Cautions. (1) Be careful that everything given to the children in these ways is of a nature to afford them genuine culture. The memory is plastic and should be employed only upon things of real value. Anything else is sheer waste of opportunity.

(2) See that capital letters, marks of punctuation and syllabication are given the same attention as the letters that form the word. Make no deviations here from standard usage elsewhere.

14. Rules for Teachers. (1) Throughout all the grades, see that every written exercise is a lesson in spelling. Insist upon accuracy and neatness from the first day to the last.

(2) Do not often conduct the written lesson for the sake of the spelling alone Inculcate a truth, and let the spelling be a necessary adjunct to its expression.

(3) When dictating words or sentences for the children to spell, follow this plan: Get the attention of the entire class; require the eyes to be fixed upon you; pronounce once, clearly and distinctly; require the class to pronounce, to write the word and to look again at you. Repeat the process. Adhere strictly to this rule from the very first in all grades, and much time will be saved and all confusion avoided.

(4) In oral spelling, have the pupils pronounce the word before spelling, pause after each syllable and pronounce the word again at the end. The pause after each syllable marks the syllabication equally well and takes far less time than to pronounce each syllable by itself.

(5) When two words having different meanings have the same pronunciation, the pupil has a right to be given the meaning of the word he is to spell, when the sentence of itself does not clearly show the meaning.

(6) In oral spelling do not pass a word missed by one child to others, as that gives the others the advantage of the previous attempts.

(7) Do not give too long lessons. Follow the suggestions previously given and review the work again and again.

(8) Do not give undue prominence to the long words. The very unusualness of their forms helps to fasten their images. Words like *which*, *whose*, *who* are often more difficult to learn than *sunflower* or *elephant*.

(9) Use constantly such devices as picturing, imaging, grouping, definitions and classifications to aid the memory in its efforts to retain the correct forms in detail, and bring in the needed repetitions by daily reviews. Keep up these lines until spelling becomes automatic.

(10) Do not make a fetich of spelling. It should not take the time that properly belongs to other studies. On the other hand, it should be kept actively and constantly before the classes as a valuable and necessary accompaniment to all the other lessons, and good spelling should be dignified as an accomplishment of high merit.

TEST QUESTIONS

1. Upon what senses does the pupil rely in learning to spell? Prepare an outline of one or two lessons that you would give second grade pupils for training their senses with a view to their direct relation to spelling.

2. Of the plans suggested under *How Much to Spell*, which do you prefer? Why? How can you so use your exercises in oral spelling as to make them helpful in written spelling?

3. How can spelling be taught so as to keep the pupils interested and prevent them from feeling that the work is drudgery?

4. Plan a method of assigning the spelling lesson to pupils in the second and third grades, thinking out your reasons for the different steps.

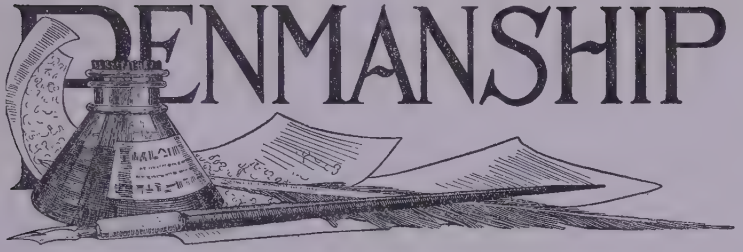
5. How does visualization in nature study and other subjects aid in spelling?

6. Why do pupils frequently misspell words when used in sentences that they spell correctly in lists?

7. Formulate a plan for obtaining material for spelling lessons in a third grade where no spelling book is used.

CHAPTER SIX

PENMANSHIP



FIRST, SECOND AND THIRD GRADES

NOTE. This chapter is based upon the *Zaner Method of Writing*, by C. P. Zaner. All the illustrations and many of the plans and directions are taken from the Zaner Manuals and are used by permission of the publishers, The Zaner & Bloser Company, Columbus, Ohio.

INTRODUCTION

1. A Means of Expression. Writing is a means of expression, "a language tool," and the child who knows how to write has an advantage over the one who has not acquired the art. "As a fine art," says Mr. Zaner, "writing is intended for the engrosser, but as a mechanical art, it is for the service of all. As a mechanical or universal art it ranks in importance with reading and arithmetic, and should be taught as efficiently and intelligently."

2. The Teacher's Problem. The primary teacher occupies a somewhat trying position in reference to teaching writing. On one hand are the parents and often the school officials who are demanding immediate results; on the other is the child whose nervous and muscular systems, when he enters school are too immature to admit of his writing so as to produce the desired results. Again, writing is both an art and act, and the first duty of the teacher is to see that right habits are formed. The teacher must look beyond present results far into the future, since wrong habits formed by the child when he begins to write must be

broken off later at the expense of much time and effort, or he will be crippled in his writing all through life.

Under these conditions the teacher should avoid either extreme, and while laying the foundation, also lead the child to begin to express himself in writing during his first year in school. The purpose of this chapter is to assist the teacher in accomplishing these results.

3. The Pupils. Many teachers fail to secure satisfactory results in writing because they attempt to teach it without an understanding of the conditions upon which success depends. At six years of age the small muscles and the controlling nerves have not developed sufficiently to enable the child to control them. To require the child to make those fine movements necessary to produce the script of the adult is to require something which he cannot do, and his efforts soon exhaust his nervous and muscular energy. Teachers who try to secure immediate results in writing usually follow this method of procedure. They may succeed in getting the little tots to copy some words from their reading lessons and possibly to scrawl their names on paper, but they are not teaching the pupils how to write in the right way.

Only the large muscles which control the movements of the hand and arm should be brought into play, and any attempt to have the pupils copy words at this stage results in the use of the finger movement, and thus lays the foundation of wrong habits. Start right; proceed along natural lines, and you will secure the desired results.

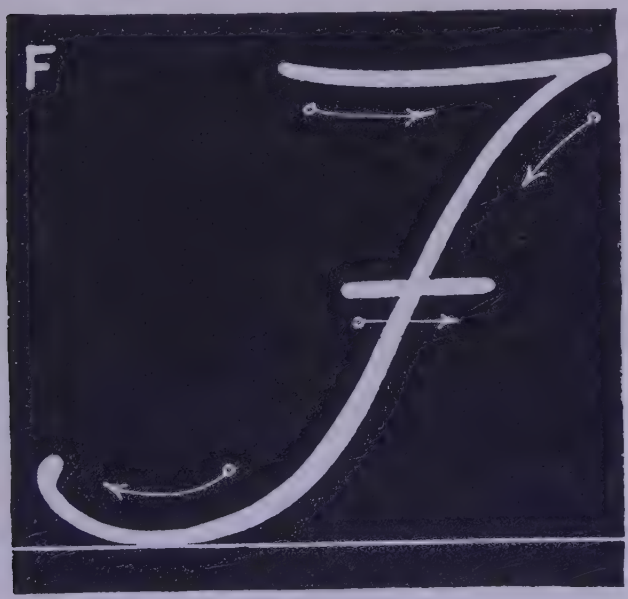
4. The Montessori Plan. Teaching the child how to do a thing before asking him to do it is the plan followed in the Montessori schools. There is no exception. By this plan the child teaches himself. The plan is so simple that any teacher can use it. It consists in providing the pupils with script letters, cut from paper or made in some other inexpensive way, and having them learn the movements for writing by tracing these letters over and over.

The Montessori letters are four inches high and are

cut from sandpaper and pasted on cardboard or wooden blocks. The letter is of one color and the mounting of another. Sets of letters like that shown in Figure 1, called *Perception Letters*, seem to have an advantage over those used in the Montessori schools because they are smooth and because the contrast between the white letter and the black background is so sharp that the form is at once impressed upon the child's mind.

FIRST GRADE

The following method of procedure is recommended:



PERCEPTION LETTER
Figure 1

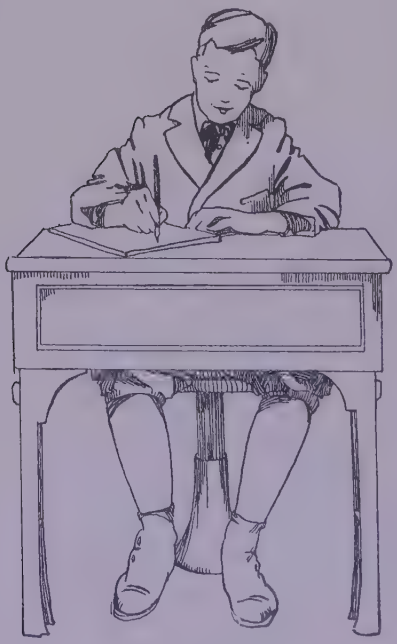
(1) Provide a set of perception letters for each room. From this set others can be made by the teacher.

(2) Group the letters according to similarity in form and construction. The grouping should follow the order of exercises presented in this chapter.

(3) Give each pupil in the class the *o* or *oval* for the first exercise and have this form traced by the pupils, each touching the letter with the end of the index finger and moving the hand in the direction indicated by the teacher, who should write a large oval on the blackboard and show the pupils how to make the movement.

Watch the pupils to see that they make the right movement. At first it should be from right to left (Exercise 1). After a few exercises with this movement, change from left to right (Exercise 2).

(4) Proceed in this way with several letters. Then review, asking the pupils to use the first and second fingers in tracing.



CORRECT POSITION
Figure 2

(5) Give the pupils a pencil that has not been sharpened, teach them how to hold it and let them take one or two lessons in tracing the letters with the pencil.

(6) Sharpen the pencils and let them write the oval.

5. Position. We have given the successive steps in the Montessori method without interruption, in order that the teacher might follow them without confusion. But there are other matters which require attention during these exercises. The first of these is position. The following directions are plain, practical and to the point:

(a) "The Body. The child should sit well back in the middle of the seat. The body should lean slightly forward,

bending at the hips and not at the waist. The feet should rest flat on the floor, slightly apart. Sit facing the desk squarely.

(b) "The Arms. The elbows should be near the edge and corners of the desk. The right arm should be raised slightly in the beginning, and until the habit of using the arm instead of wiggling the fingers is established. This may be the first or the second year, depending upon the teacher and the child.

(c) "The Hands. The right hand should hold the pencil between the thumb and first and second fingers. The end of the first finger should be at least one inch from the end of the pencil. The left hand should hold the paper along the left edge, and it should shift to move the paper sidewise and upward as one writes across and down the page. The hands should be held naturally and efficiently. The fingers should be curved slightly, and the hand should glide on the nails of the third and fourth fingers. The thumb should be nearly opposite the first joint of the first finger. The end of the first finger should never be even with or back as far as the end of the thumb. The left hand should hold and move the paper. Only the first finger should be on top of the pen.

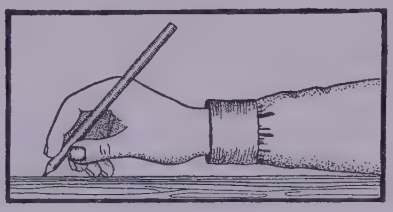


Figure 3

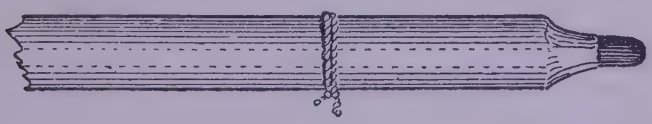


Figure 4

(d) "The Pencil. The pencil, and later the pen, should be held between the thumb and first and second fingers. It should be held loosely and point toward the shoulder. The pencil should be large and sharpened as

shown in the accompanying illustrations (Figure 3 and Figure 4). The lead should never be pointed; only the wood cut away, using a curved stroke. A string tied tightly around the pencil about one and one-half inches from point helps to keep the little fingers from creeping down too close to the pencil point. By putting the first finger in front of the string and the thumb back of it, correct adjustment of these fingers is secured; for the thumb should be kept back of the first finger.

(e) "The Paper. The paper should be ruled the long way, not less than one-half-inch lines for the first year and three-eighth-inch lines for the second year, and about eight by ten inches in size. It should be placed nearer the right than the left side of the desk, and turned as shown in diagram." (Figure 5.)

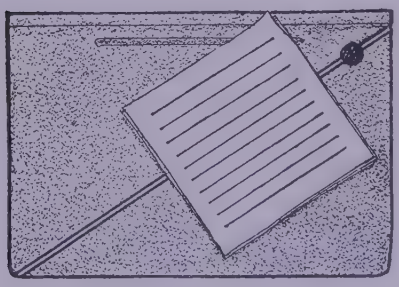


Figure 5

(f) Importance. The importance of training pupils to take and maintain the right position from the beginning cannot be emphasized too strongly, and every exercise in penmanship in the primary grades should begin with a drill on position. This may not require more than a minute or two, but the teacher should see that every pupil is in right position before beginning to write.

"If you cannot teach position, you cannot teach writing correctly. And the postures of your pupils while writing are the evidence that you succeeded or failed, depending upon how straight or how stooping they sit.

"It is also well to bear in mind that inasmuch as writing becomes a mechanical art, the right mechanical adjustment of the writing machines is vital and of *first* importance."

6. The Blackboard. The first exercises in actual writing

by beginners should be on the blackboard, and these exercises can be interspersed with those described under the Montessori plan, thus lending variety and adding interest to the work.

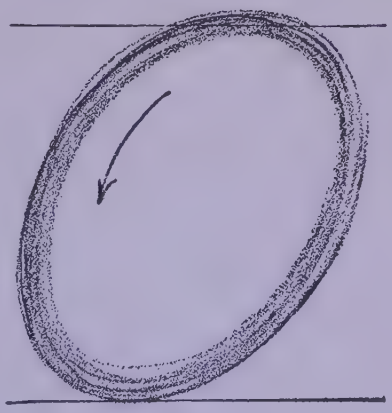
(a) Teacher's Preparation. Ability to write well upon the blackboard is the first essential to success in teaching writing in the primary grades. Writing upon the blackboard requires but little skill — far less than writing on paper — and no teacher can offer a valid excuse for not acquiring this accomplishment. All it requires is the selection of simple forms of script and practice on these forms until they can be written correctly and rapidly.

The teacher should not only be able to write well, but also to show her pupils how she does it. Children are imitators, and a demonstration that takes less than a minute is more effective than any long worded explanation. Act your instructions and the pupils will follow you.

"Inspire by showing, encourage by helping, direct by suggesting, instruct by describing and thus guide the little bundles of spontaneity through innumerable falls, failures, mishaps, blunders and mistakes to successful writing."

(b) The First Lesson. When the pupils are given blackboard exercises in writing, the teacher should devote her entire attention to the exercise.

(1) Divide the blackboard by vertical lines into spaces about twenty inches wide. In each space write an oval, placing it low enough so the pupils can see it. (Exercise 1.)



Exercise 1

(2) Send the pupils to the board and supply them with crayon. The crayon should be broken so that the pieces will not exceed one and one-half inches in length.

(3) Show the pupils how to hold the crayon (Figure 6). Ask them to hold their hands so that you can see that each pupil holds the crayon as directed.

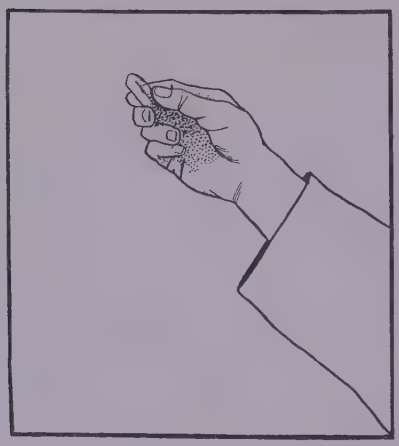


Figure 6

(4) Have the pupils step far enough from the board to allow the hand to touch it easily, and have them make the motion several times before touching the crayon to the board.

(5) Give the direction, "Write," at which the pupils begin the oval, moving the hand down on the left side and up on the right.

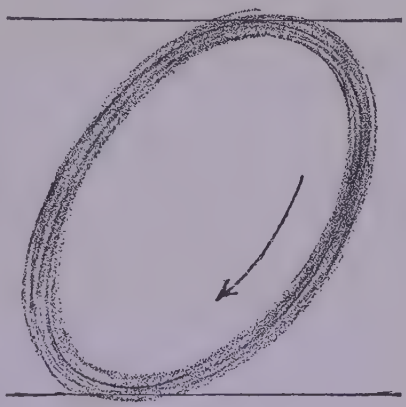
At the first and possibly the second exercise the little hands will move slowly, but the pupils should be encouraged to increase their speed. This can be done by counting one for each sweep of the arm, as one, one, one; down, down, down, etc. At first count about fifty to the minute. When the pupils have become familiar with the movement, the speed can be increased, but the counting should never be so rapid as to cause the pupils to worry or to become easily fatigued. The ovals should be about four inches high.

Cautions. (1) These first exercises should continue for only a few minutes, six or seven, and never to exceed ten, since everything is new and the children easily become fatigued.

(2) Much of the work will be crude for the first few days, and it may be three or four weeks before all the children are able to make good ovals of the required size. Do not become discouraged over the slow pupils. Their difficulty is physical, and as soon as nerves and muscles are brought under control they will write as well as those who grasp the movement at the start.

(3) Do not worry or nag slow pupils, but lend them a helping hand now and then.

(c) Other Lessons. (1) Let the plan adopted for the first lesson be pursued in all others so that the pupils will know just what they are to do, then drill until they do it quickly and quietly. Count in all drill exercises.

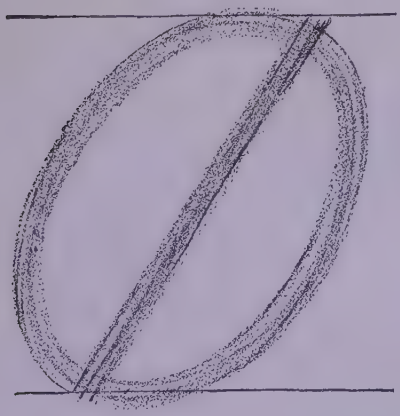


Exercise 2

(2) After the pupils have practiced on the direct oval for a number of exercises give them the reverse oval (Exercise 2).

(3) This should be followed by the oval with the straight line running through the center (Exercise 3).

(4) Take one thing at a time and proceed with that until some progress has been made, then change to something else to avoid monotony. In this way exercises can be repeated many times and still hold the interest of the pupils.



Exercise 3

7. Seat Work. The steps leading up to seat work have already been given, and allowing the pupils to write as soon as they have learned the movement for the oval will encourage them. Exercises 1, 2 and 3 should be practiced at the seat in the same order as given on the blackboard.

(a) General Directions. The following general directions will be found helpful:

(1) "Draw diagonal deskline and see that pupils use it.

(2) "Be sure that arms move instead of the fingers.

(3) "See that each child is supplied with a copy for close observation.

(4) "Be sure to see that the pupils observe you write the copy on the board.

(5) "Stop pupils when position is poor and then give some drill to strengthen position.

(6) "Have pupils use large writing in all written work. Accept no other and you'll get no other.

(7) "Know when to quit talking and give the children a chance to write. They learn best through writing.

(8) "Avoid the tedious and technical. Direct activity; do not put a quietus upon it except when positively wrong.

(9) "Children need large pencils, copies for perception and practice, suitably ruled paper, and a sympathetic, efficient teacher."

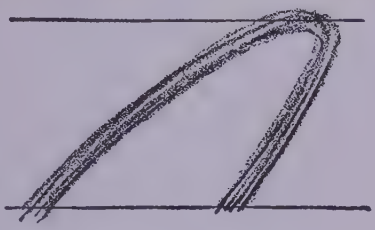
(b) Suggestions. The tendency of pupils at this time will be to write large and it is a good plan to have their paper ruled in inch spaces. As they become accustomed to the movement, this space can be narrowed until it is reduced to one-half inch.

(1) Begin each exercise by calling attention to position and see that the correct posture is maintained throughout the exercise. Correct posture and right movement will insure good writing in the end, and at this stage they are far more important than following set copy of letters.

(2) Let the pupils write ovals in groups of three, first the direct and then the reverse. This is the first direct step towards writing words and you should explain this fact to the pupils for their encouragement.

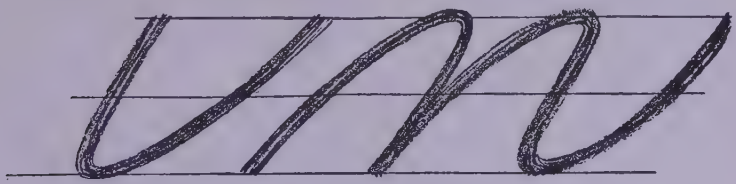
8. Additional Principles. The oval and the straight line which are combined in Exercise 3 acquaint the pupil with the round and the up and down, or "push and pull" movements, and when he has learned these movements he is well

on the road to the mastery of writing as a mechanical art. You should now introduce the upper curve principle (Exercise 4), which combines a part of the oval with the straight line. After three or four exercises on this, introduce the lower curve principle (Exercise 5).

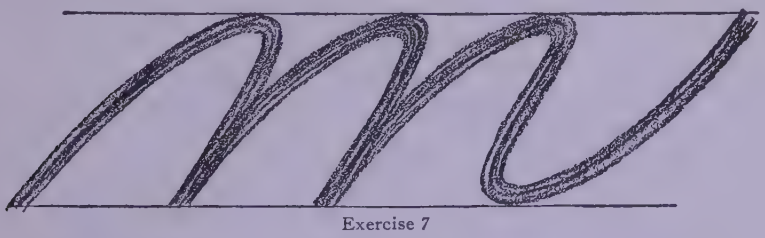


Exercise 4

9. Combining Principles. The pupils are now ready to combine principles to form letters. The oval forms the *o*; the upper curve and lower curve principles unite to form *n*. (Exercise 6.) By repeating the upper curve principle we have the *m*. (Exercise 7.) Combine the first part of the upper curve principle and the oval and we have the *o*. (Exercise 8.) Have the pupils cover several sheets with *o's*, first



Exercise 5 Exercise 6



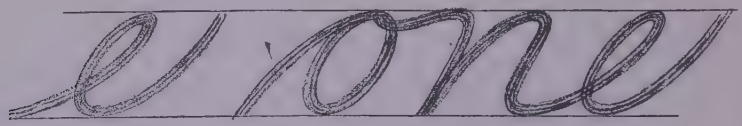
Exercise 7

Exercise 8 Exercise 9

making them singly, then joining three or four together. Write by counting. Combine the *n* with the *o* and write *no*. (Exercise 9.)

Change the position of the letters and write *on*. (Exercise 10.)

Give *e* for the next exercise, showing the pupils how to make it. (Exercise 11.) Practice several pages of *e's*. Count.



Exercise 11 Exercise 13

For the next step let the pupils combine the *m* and *e*, making *me*. (Exercise 12.) Now combine the *o*, *n* and *e*, forming *one*. (Exercise 13.)

(a) Suggestions. (1) Let writing on the blackboard and at the seat alternate in all these exercises.

(2) Show the pupils how to take each new step by writing the new letter or the new word on the board for them.

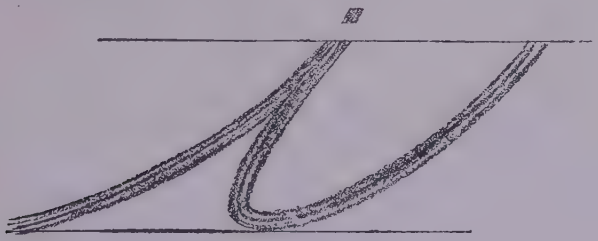
(3) Help the slow pupils to overcome their difficulties by suggestion and encouragement.

(4) Do not call attention to incorrect forms. Erase the wrong character and show the pupil how to make it right.

(5) "Eternal vigilance" is the price of good writing; watch posture and movement. Demand large writing and insist upon the arm movement.

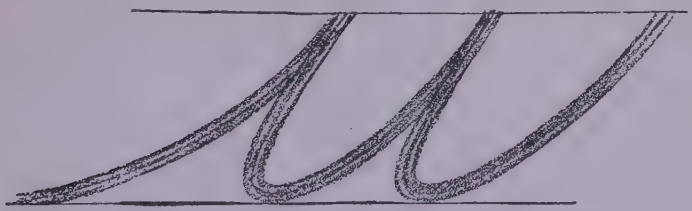
10. Reviews. The pupils have now learned several letters and words. A review exercise in which they are required to write all the words they have used in the previous exercises will show what they have gained, and also the points which need strengthening. Tell the pupils that, if they do well, they can take their papers home to show father and mother. You will find this an incentive to their best effort.

11. More Letters and Words. Teach the pupils to make *i* and *u*. (Exercises 14 and 15.) The *t* is like the *i* except



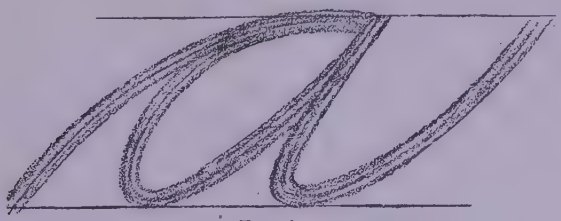
Exercise 14

that it is a half space taller and has a line across it near the top. The pupils are now ready to write *it, in, see* and *see me.*



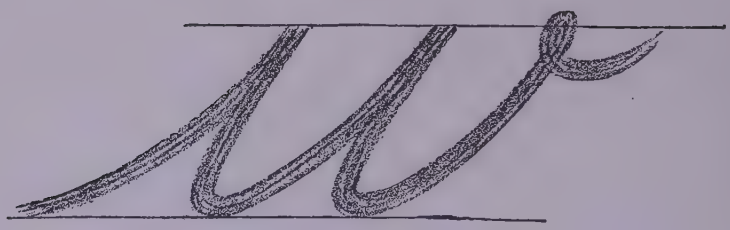
Exercise 15

Another group of words may include *is, so, us, use.* Teach *a, w* and *v,* showing the pupils how each is made. (Exercises 16, 17, 18.) Follow these with *r, d* and *c.*

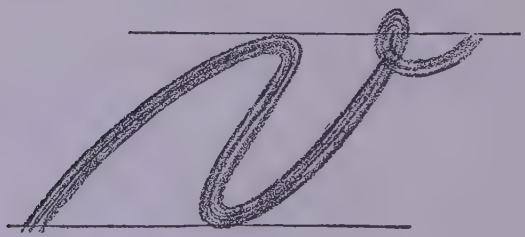


Exercise 16

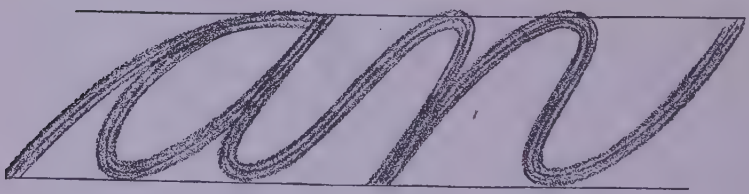
(1) Give exercises which will include words that can be made from these letters. Note that *x* (Exercise 19), is a combination of the upper and lower curve principles, and show the pupils how to make it.

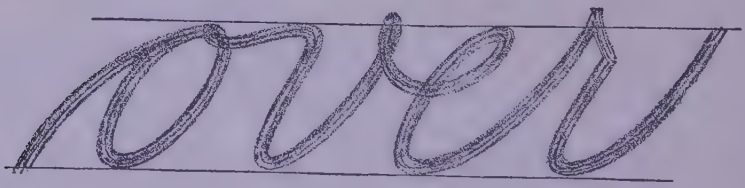


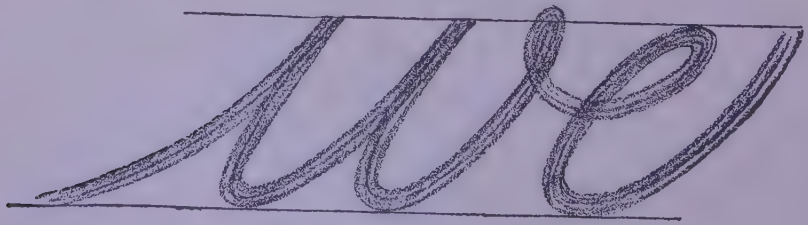
Exercise 17



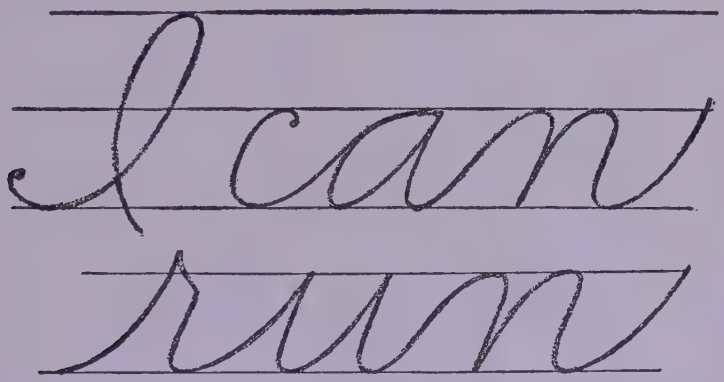
Exercise 18







(2) You now have taught all the letters without stems or loops. These letters and the order in which they should be taught are shown in the illustration. As fast as possi-

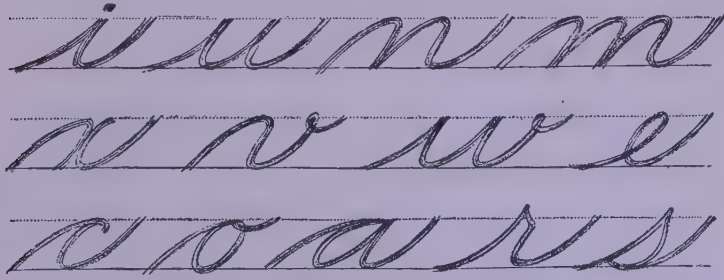


ble combine words into sentences as, *See me run*; *I can run*; *See the cat*, etc.

(3) Try to introduce something new as fast as the pupils are ready for it and thus keep interest alive.

(4) Let a part of each exercise be devoted to drill upon the principles, the ovals, the push and pull movement and the upper and lower curves.

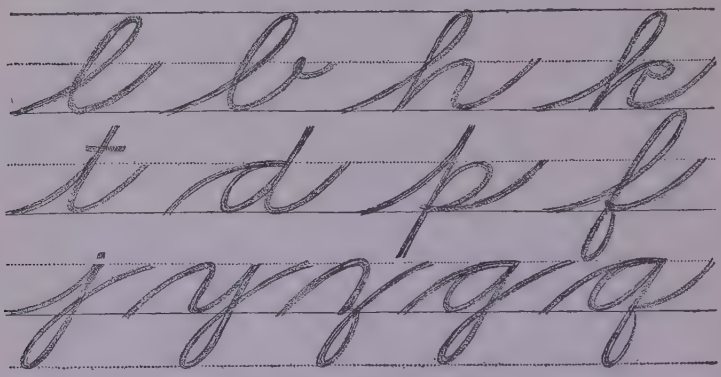
12. Loop Letters. The loop letters are considered more difficult than those given in the preceding exercises, but



LETTERS WITHOUT STEMS

they should be introduced at this point, or before, as the teacher may think best. It is better to show the pupils

how to make them than to take time to explain them in this grade. With each letter follow the plan already given



LOOP AND STEM LETTERS

— show, drill, combine into words. The order in which these letters should be presented is shown in the illustration.

13. Writing in Smaller Space. Up to this point our illustrations of letters have been large size and have been those

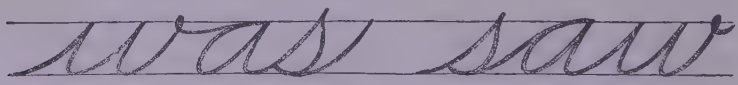
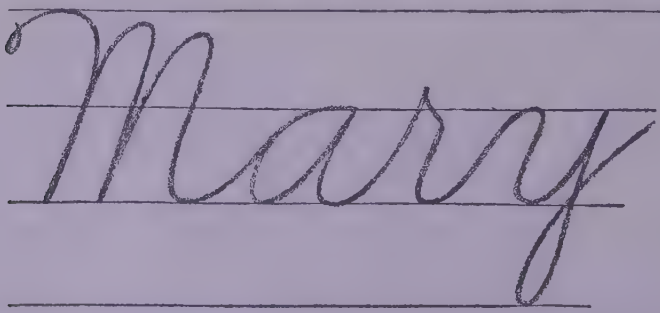


Figure 7

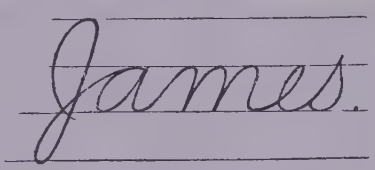
of traced letters. But we have stated in Section 5 that the lines should be at least one-half inch apart on ruled paper



and that gradually the pupils should be led to write down to this space. During the last half of the year the writing

should begin to resemble that shown in Figure 7. Three to five minutes' drill daily on ovals and other principles, requiring the pupils to keep within the space between the lines, will in time produce the required result.

14. Capital Letters. It is not wise to discuss capital letters in connection with the writing lessons with first grade pupils further than to fix in their minds that these letters are used when we begin a sentence and in writing a person's name, as "We make a large *M* when we write *Mary*, for this is a girl's name, and we use a large *J* in *James* because that is a boy's name." When a capital is needed, show the pupils how to make it, then in future exercises overlook the work to make sure that they have not forgotten the lesson.



15. Written Exercises. As we said in the beginning, pressure is often brought to bear upon the primary teacher to produce written work. No written work should be done in this grade that is not carefully supervised. To require pupils to copy forms and words with special emphasis placed upon the form, before they have acquired the right posture and movement, is fatal to good writing. During the last half of the first year, short written exercises may be given, but the practice common to some teachers of sending these children to the board to write words from their reading lesson the first day of school, results in an injury to the children and does not help them in learning to read.

The great purpose of the writing lessons during this year is to begin the formation of right habits of writing. The teacher who adheres to this purpose will be amply rewarded with the results obtained.

SECOND GRADE

16. Purpose. The teacher should have clearly in mind the twofold purpose of the work in writing for the second

grade, namely: "To provide means of written expression at the earliest moment consistent with health, effort and time, and to train for efficiency, present and future."

Large writing makes this possible, since it enables children in these grades to express themselves in writing in the different subjects without undue effort and nerve strain. Therefore the arm movement learned in the first year should be continued through the second, but the writing should be reduced in size until at the end of the year pupils write easily between lines three-eighths-inch apart. By the end of the year most of the pupils should be able to write an even hand resembling the illustration below (Figure 8) when written in three-eighths-inch space.

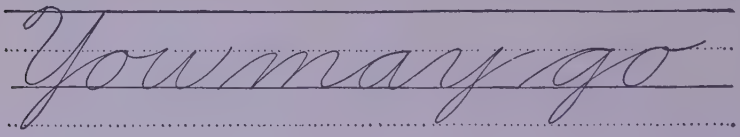
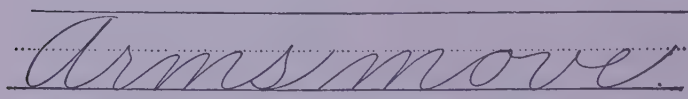


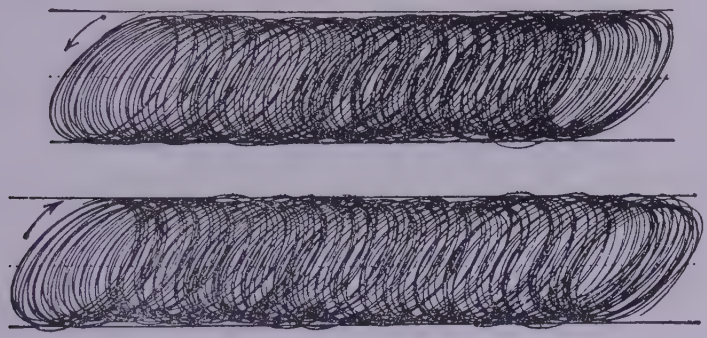
Figure 8



17. Drills. The work in the second grade should be a continuation of that begun in the first. The pupils are now older and they also have the advantage of one year's drill; consequently, they should be able to make greater progress and obtain better results. Daily drills are necessary, both on the blackboard and at the seat. If the writing period is short, however, blackboard and seat exercises may alternate. Every exercise should begin with attention to posture and movement. These should become fixed habits by the end of the year and this will be accomplished with most of the pupils if the teacher gives careful attention to the writing lessons.

18. Reviews. The pupils will have had little or no practice in writing during the long vacation, and they will have

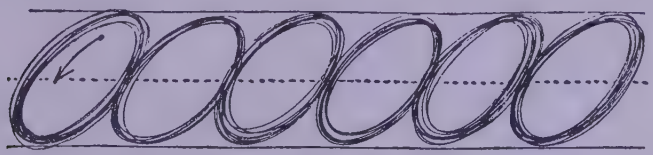
forgotten some of the directions given in the first grade; therefore they will not write as well when they enter the



second grade as they did at the end of the first year. The teacher should begin the writing lessons by reviewing the exercises of the first grade to bring the pupils back to their

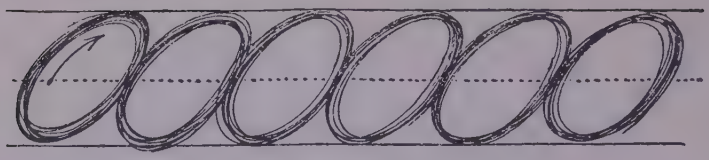
former condition. Introduce some new feature as soon as the class can make good use of it, so as to keep their interest.

19. New Exercises. The following exercises are excellent for the first new drills in this grade. The movement should

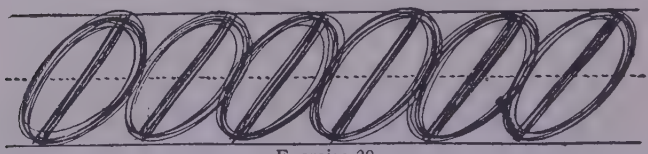


Exercise 27

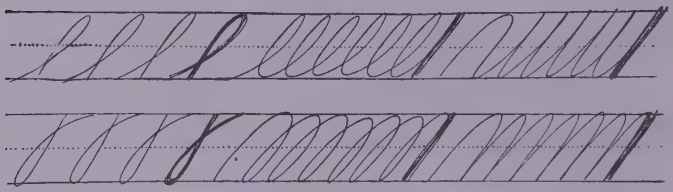
be from 120 to 150 downstrokes a minute. Rule paper in three-fourths-inch spaces for these exercises.



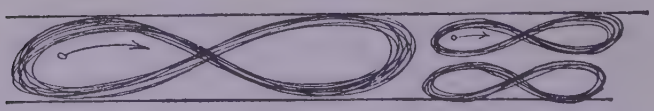
Exercise 28



Exercise 29

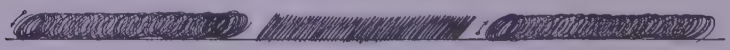


Exercise 30 Exercise 31

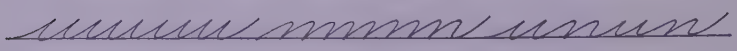


Exercise 32

Follow these by Exercises 27-32, using the same ruling as for the others. Notice the relation of these exercises to the loop letters.



Exercise 33 Exercise 34 Exercise 35

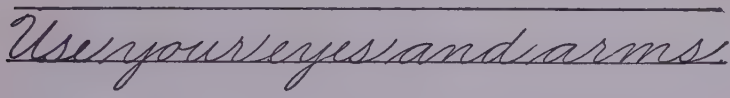


Exercise 36 Exercise 37

Let Exercises 33-38 follow. These should be written in three-eighths-inch spaces.

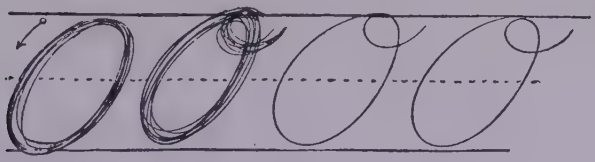
20. Letter Analysis. The pupils are now old enough to

give some attention to the combination of principles in the formation of letters. When they understand how they can



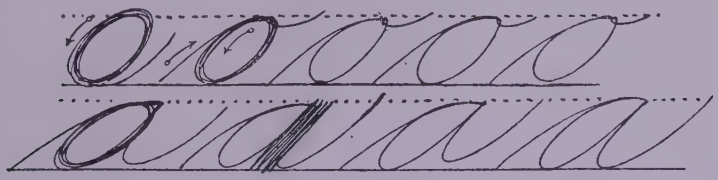
Exercise 38

make use of their drill exercises in real writing, they realize that these exercises are for a purpose.



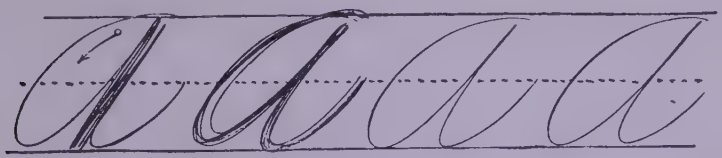
Exercise 39

(1) Begin with the oval and show how the *o* is made from it by comparing with it the first part of the upper curve principle. (Exercise 39.)



Exercise 40

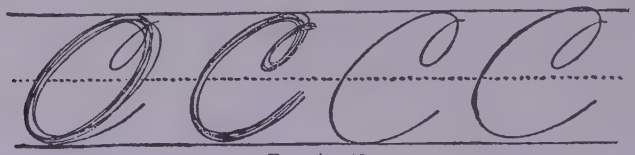
(2) From the *o* to the *a* is an easy step. Here we have a combination of the upper curve, oval, push and pull and lower curve. (Exercise 40.)



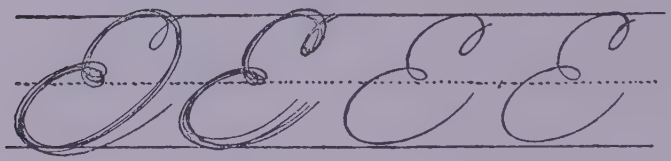
Exercise 41

(3) Show that the difference between capital and small *a* is one of height only, the capital occupying two spaces (Exercise 41). See how many capital letters are simply the

small letters made larger. You can find these on pages 453, 454. Teach these in the same way you taught capital *a*.

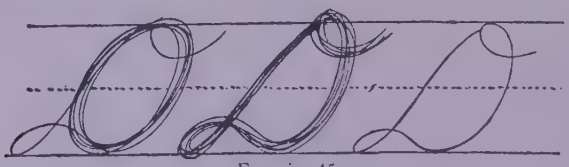


Exercise 42

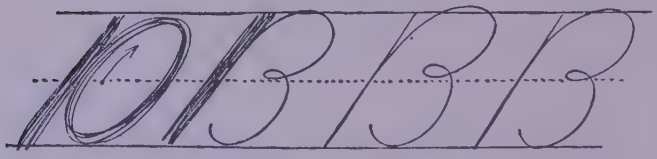


Exercise 43

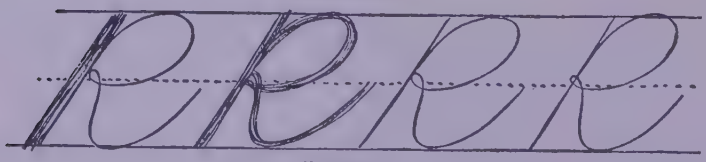
(4) Show how *c* and *e* are made from the oval (Exercises 42-43).



Exercise 45



Exercise 46

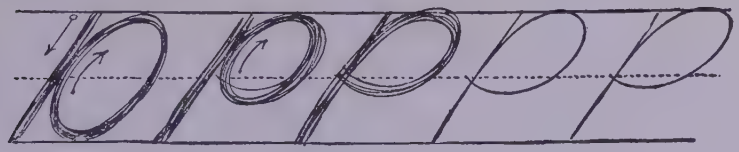


Exercise 47

(5) These analyses afford good opportunities for teaching the formation of those capitals not resembling the small letters (Exercises 45, 46 and 47).

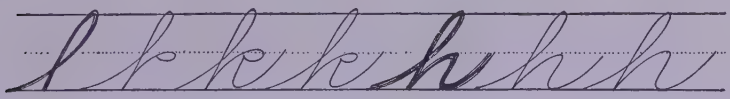
(6) The reverse oval enters into the formation of a num-

ber of capitals (Exercise 48). Write this in three-fourths-inch space.



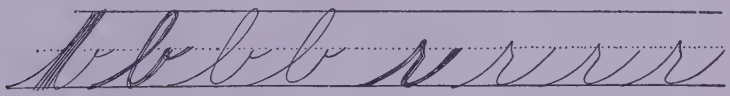
Exercise 48

(7) Some of the small letters should also receive special drills based upon analyses of their construction (Exercises 49, 50 and 51). Write these exercises in three-fourths-inch



Exercise 49

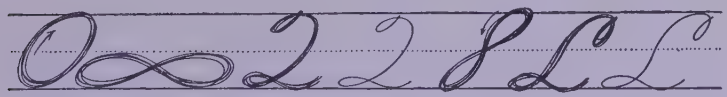
spaces. Give similar drills on the *q*, *g* and *f*, which is a double-loop letter.



Exercise 50

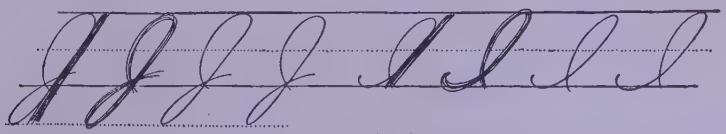
Exercise 51

(8) Some capitals require special attention as the *Q* and



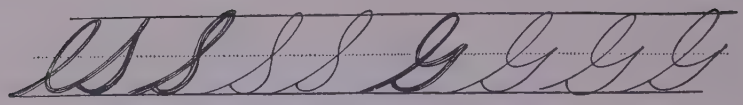
Exercise 52

L (Exercise 52). Write this exercise in three-fourths-inch space.



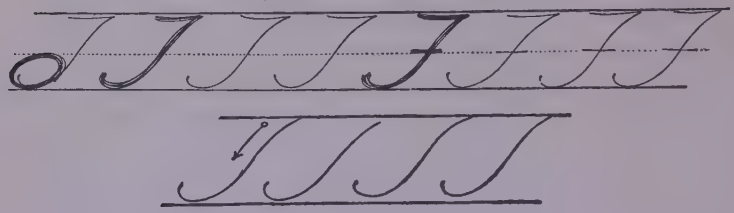
Exercise 53

(9) Give special drill on *J* and *I* (Exercise 53). *S* and *G* form another group (Exercise 54).



Exercise 54

(10) Give special drill on *T* and *F* (Exercise 55).



Exercise 55

21. Figures. Figures are more difficult to make than letters and they will require a good deal of attention. The importance of making figures legible should be dwelt upon frequently. An obscure letter may be determined by the spelling of the word in which it occurs, but every figure

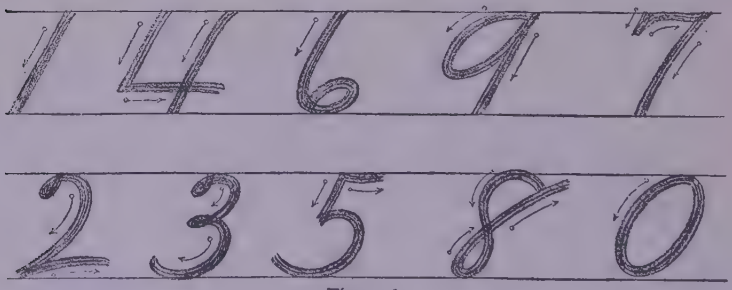


Figure 9

must stand by itself, hence special care should be taken to make figures legible. Figure 9 shows the movements necessary to make each figure.

22. Use of Pen and Ink. In most schools the pupils can begin the use of pen and ink by the middle of the second year, but if conditions are not favorable this can be deferred until the beginning of the third year. It is often advisable to give some pupils in the class the pen before

it is given to others. If one child has acquired the skill which will enable him to use the pen, he should not be held back because a slower pupil has not acquired that skill. Sometimes the promise to give each pupil a pen when he has shown his ability to use it is a strong incentive to good work on the part of the entire class.

When the pen is introduced its use should be encouraged, and it should gradually replace the pencil until, in the upper grades, the use of the pencil is limited to figuring and drawing. The continual use of the pencil is an obstacle to writing well with the pen, since the pen requires a light touch and the pencil a heavy one.

(a) MATERIALS. Good tools are essential to good work. The following description of material furnishes an excellent standard for guidance:

"The holder should be of wood and so shaped as to keep the fingers back off of the pen and the right distance from the point, which is one inch.

"The pen should be smooth pointed and not very fine, yet not very coarse. It should be held so that both points touch the paper, and not on one side.

"Ink should be taken sparingly by dipping the pen into the ink just up to the top of the eye.

"Encourage a light touch of the pen to the paper, and drill considerably with a dry pen before starting with ink."

(b) MOVEMENTS. In using the pen, the arm should rest on the desk as shown in Figure 10, and the tips of the

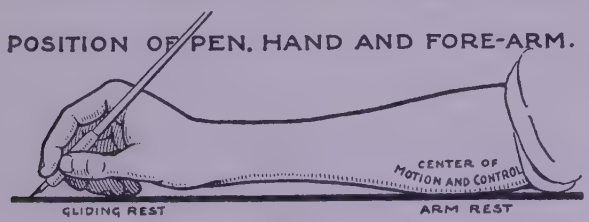


Figure 10

third and fourth fingers should touch the paper so as to glide over it. The whole arm movement should not be

used with the pen, and one of the necessary requisites to the introduction of pen and ink is the ability of the pupils to use the movement here described. Many drills with the pencil will be necessary before this stage is reached.

(c) Directions. The pen is a new tool to the child, and he needs explicit directions as to its use and care.

(1) Insist upon a light touch from the first. Show the pupils that they need only to touch the pen to the paper to have it make a mark.

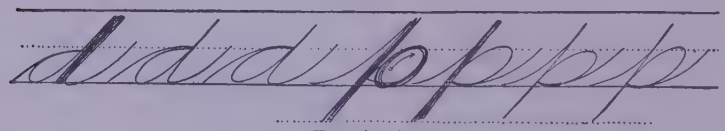
(2) Show the pupils how to dip the pen into the ink so as to take just the right quantity. Without such directions most pupils will dip the pen into the ink too far and, as a result, blot their paper.

(3) Show the pupils how to use the blotter and how to clean the pen when through writing.

(4) Insist upon neat work from the beginning and accept no other.

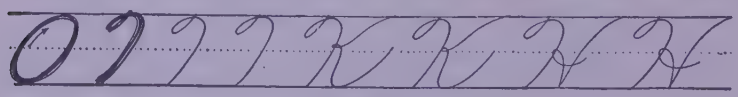
(5) Watch posture and movement constantly. The introduction of the pen will doubtless cause some pupils to change their position for supposed temporary advantage.

23. Written Exercises. The amount of written work in the second grade should be increased throughout the year,



Exercise 56

but all the exercises should be brief, and the writing should be supervised by the teacher to see that nothing is done to



Exercise 57

interfere with the writing habits she is striving to form. All too often written exercises are so conducted as to cause

the pupils to lose what they gained in the writing lesson towards becoming good writers.

Exercise 58

THIRD GRADE

24. Third Grade Essentials. This is a movement grade and movement should be emphasized more than form. "Only the essentials of legibility as concerns form should be emphasized at this time." This does not mean, however, that form should not receive attention, but this attention should be of the right sort.

"The sharpness and dot of the *i* need to be emphasized rather than its size, width or slant. The three turns and one angle of the *n* need to be located and fixed.

"The shoulder of the *r*, the finish of *v*, *w* and *b*, the round bottom of *s*, and the endings of *o* and *a* need careful attention.

"The endings of letters need more attention than the beginnings.

"The size of the beginning loops of more than half of the capitals is of less consequence than that the turns, angles and retraces are distinct.

"Script forms were evolved to represent sounds, and not to serve geometry or fine art. The object of writing is to express and record thought, not to display skill or beauty. Plainness in record rather than accuracy or beauty should therefore be the primary thought of the teacher, and efficiency in expression rather than skill or beauty in such.

"Instead of technical accuracy as an ideal for form, *gracefulness* of form is better, because it embodies pleasing qualities and plainness of form, and at the same time it typifies ease and rapidity of movement. Ease of reading and writing are equally important, and both need emphasis.

"Theoretically, form is of first importance, but prac-

tically movement needs more emphasis than form because it involves method (the how) and because writing is difficult and skilful from a manual rather than from a mental standpoint."

25. Conditions. When the child enters upon his eighth year a new period of development begins, and in the readjustment of nerves and muscles there is usually a falling away from the accuracy of movement attained during the previous year. This has an unfavorable effect upon the writing, and teachers, who do not understand the cause, are prone to attribute it to carelessness or perversity on the part of the pupils, when the real cause of the poor writing is physical, and, for the time, beyond the child's power to control.

Teachers should be patient and sympathetic with children of this age. Scolding, constant faultfinding and nagging soon place them in a frame of mind that makes good work impossible. Muscles are now in a plastic state, and perseverance in fixing right habits of position and movement will put the child in condition to write well in the years that follow. Therefore the teacher should not be discouraged. She should, on the other hand, adapt the writing lessons to conditions, give plenty of exercises in movement, and such attention to form as may be necessary to legibility; thus training her pupils for future usefulness.

26. Suggestions. The following suggestions will be found helpful:

(1) "Pass the writing books out for each lesson with the other writing materials.

(2) "Write the copy on the board while the pupils watch you.

(3) "Count for your pupils now and then to show them how fast to write.

(4) "Stop pupils' writing when positions are poor, and strengthen them before proceeding.

(5) "Have pupils motion letters and words; this will encourage foresight and freedom.

(6) "Use practice paper freely but fill it systematically, and then put the best writing in the Practice Book.

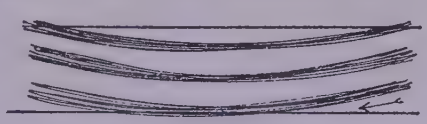
(7) "Put the alphabet at the top of the board so that pupils will use the correct styles in all of their writing.

(8) "Give a writing lesson each day.

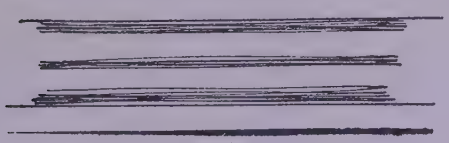
(9) "Materials: Good paper, properly ruled — shapely wood holder — good quality of pens, not too sharp nor too stiff."

27. Reviews. Take the first week to review the work of the second grade. Teach position and movement as thoroughly as if they had not been previously taught. Let these review exercises include both blackboard and seat work.

28. New Exercises. The exercises given for the first and second grades practically cover the movements used in all writing. These exercises should be repeated in drills, but they should be written in narrower space, as shown in Exercises 28, 29, and 30, which should be written in the space given. Exercises 31, 32 and 33 should also be written in the space given. Note the relation of Exercise 32 to the stems in 52. Also the relation of this exercise to capital *S* and *G*.

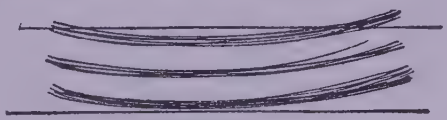


Exercise 59



Exercise 60

Exercises 59, 60 and 61 are new and should be practiced to help the pupils to obtain a free and easy movement of the hand across the page.



Exercise 61

29. Written Work. In the third grade pupils should be taught to arrange their written work in good form. As in the grades below, written work should receive supervision,

but it will not need as much attention as the lower grades require if the work up to this time has been properly done. More work can and should be required, and pupils should be allowed to take specimens home at frequent intervals.

30. **Criticism.** Letter analysis can be carried further than in the second grade and this gives the teacher opportunity to call attention to defects that are common to most of the class. In doing this she should write and explain the letter and show how the defect can be remedied. Let this criticism be followed by a drill upon the letter or word criticised, directing the class to give special attention to the correction needed. In this way take one letter or principle at a time and you will do much to bring the writing up to the desired standard.

Caution. Do not give lessons on criticism too often, not more than twice a week, for your pupils may become discouraged. Give them a chance to correct one fault before calling attention to another.

TEST QUESTIONS

1. Of what importance is writing as a school subject?
2. Why should good penmanship habits be taught from the very first?
3. What should be the first steps in teaching penmanship?
4. Explain the principle used in teaching writing in the Montessori schools.
5. What are the correct positions for the following: the body, arms, hands, pencil and paper?
6. Describe the steps which precede seat work.
7. What principles are combined in forming letters?
8. What should be the purpose of the work in the second grade? The third grade?
9. How should the teacher employ criticism?

CHAPTER SEVEN

USE OF THE SENSES

1. Function of the Senses. The child gets all his primary ideas of the external world through the use of his senses. Upon the activity of the senses all mental action is based. The things of the external world impinge upon highly specialized nerve ends, which are called sense organs, and stimuli are carried along the nerves to the brain. If the brain is conscious of the report, it makes some kind of a response; so the brain and the world act and react upon each other through the mediation of the sense organs. Were it not for the senses, the brain and the world would have no way of influencing each other. There are five such senses through which the external stimuli act — sight, hearing, touch, smell and taste — and the order in which they are named somewhat suggests the order of their educational importance. Sight, hearing and some uses of touch are highly educative, and furnish the material out of which grow the images necessary to intellectual life. Other uses of touch, taste and smell minister primarily to the body, seizing upon or warding off those things useful or harmful to physical life. However, there is no sharp line of difference between their intellectual usefulnesses, and the more senses that are used upon a given object, the more information concerning it the mind obtains.

2. Relation of the Senses and Knowledge. A baby seizing upon a new and interesting object subjects it to all of the

tests of his senses. He grasps it in his hands, feels of it, gazes at it, pounds with it, puts it into his mouth. The knowledge he gains thereby is a vital, personal and somewhat definite thing to the child, with which the mere verbal description given him by an older person would in no way compare. To attempt a comparison of the child's knowledge of a doll as gained by his own investigations, using his senses, and as gained by hearing an older person's verbal description of it, shows the unlikeness of the two experiences. His observation of the doll is necessary to put content into, or give meaning to, the verbal description.

The mind of the child at six years of age is not so different from the baby's mind that the school is warranted in completely changing the method of learning from observation, through the use of the senses, to learning about things through words of books or teachers. The child and the adult learn in the same way. There are discoverable principles of mental action common to both, and this readiness to seize upon the environment by means of the senses is one such principle, only that, to the child, the sense element plays a greater part. All recognize that even adults, somewhat habituated to dealing in abstractions, comprehend a new object more readily if they use their senses upon it. For this reason the stereopticon lecture appeals to the public more readily than the unillustrated lecture. Shopkeepers cannot prevent waste due to the tendency of the public to touch and handle objects. Even in art galleries, where the appeal of the objects is wholly to the eye, signs are posted forbidding the touching of pictures and statuary. These and many other illustrations, which you will readily recall, prove the general activity of the senses through life.

3. Necessity for Use of the Senses. Finding that the senses offer a tangible, concrete means of investigating things, we may safely assert that the child's senses are a factor to be utilized in the educative process. The statements of many people are unreliable because their observa-

tions have been made so carelessly that they are not able to give exact information. The special senses should be used as tools for investigating objects of interest to the child, and the teacher should make such requirements and arouse such inquiries that the child will use his senses carefully and definitely.

4. Defective Sense Organs. It is the teacher's first duty to ascertain whether or not each pupil's organs of sense are in a healthy, normal condition. Investigations of school children indicate that about twenty per cent are defective in hearing in one or both ears. A large proportion of the children considered peculiar, dull or inattentive are found to be defective in hearing. It is obvious that grave injustice is done these children if such defects are not discovered and corrected as far as possible. It is also futile to present lessons with a view to the child's getting sense-impressions if the outer organs are so defective that they cannot respond properly to stimuli. At free moments the teacher should make a series of tests, in order to determine for herself the condition of the eyes and ears of her pupils. Full directions for making these tests and for such adjustment of light and desks as will protect the eye from injury are given in Vol. III, Chapter VII, *Sanitation and Hygiene.*

(a) Development of the Sense Organs. A child five or six years of age has keen senses, but his sense organs are not fully developed, therefore he cannot recognize fine distinctions. Pupils of primary grades should not be given exercises requiring such distinctions. To illustrate, if a class of first grade pupils are given a dandelion to study, they should not be asked to dissect the composite flower, which to them appears as one, instead of being made up of many minute flowers. The leaves, the stem, the head and the color of the flower are all the features they should be expected to notice at this time. This principle applies with equal force to all lessons in the primary grades. The children readily distinguish between the prismatic colors and between those shades of the same color that present a

strong contrast, but they are unable to distinguish between delicate tints that closely resemble each other.

This gradual development of the sense organs makes sense training necessary in all the grades, and all keen observers give their sense organs continuous training. The development is twofold — perfection of the finer structures in the sense organs, such as the rods and cones in the retina and pillars in the organ of Corti in the ear, and the development of the sensory centers in the brain. Since these centers do not reach maturity until the close of the adolescent period, one can readily understand the necessity of this continuous training.

(b) The Functions of Each Sense. Each set of sense organs conveys to the mind ideas peculiar to itself, and which primarily cannot be conveyed through any other channels. A person born blind never has an idea of color, and one born deaf never has an idea of sound. Some blind people form apparent exceptions to this, but in every instance these people became blind after birth, relying, after their misfortune, upon their past experiences.

(c) All the Senses Must Be Used. To appeal to some senses and neglect others is to give the child a one-sided mental development, because each sense contributes something to his store of knowledge which none of the others can supply. The sense of sight is more easily appealed to than any other, and teachers are prone to arouse images gained through sight, to the neglect of hearing, touch, taste and smell. Primary knowledge obtained through the eye alone is incomplete.

(d) Proper Physical Conditions. The senses are keenest when the body is in an unwearied condition. This keenness is dulled by general fatigue or a prolonged use of the special organ. An odor which at first is disagreeable is soon tolerated, and a little later is scarcely noticed. Water which feels hot when the hand is first plunged into it seems to cool quickly, because the sense of touch has become accustomed to the temperature. Nervous diseases often

irritate the organs of special sense and lead to abnormal activity. Sometimes, in children of nervous temperament, some of these organs are abnormally sensitive; a slight sound causes the child to jump, and a touch to which others would give little heed, produces pain. Such children should be watched very carefully to see that their senses are not unduly excited by any school exercise.

5. From Objects to Books. Previous to entering school, the child's experiences have been almost entirely with objects, and his store of knowledge has been accumulated through these experiences. He knows little or nothing of symbols, and the transition from the object to the symbol is a very difficult step — more difficult than many teachers realize. Therefore this change from objects to books must be made gradually, if the child is to apprehend the meaning of the symbols. The child may be able to comprehend four when four objects are given him, but the word *four* and the figure 4 mean nothing to him. Nevertheless, he can be taught to recognize both word and figure so that he will name them at sight without knowing their meaning. Much of the number teaching is of this sort, and this accounts for the lack of understanding of arithmetic so frequently found in intermediate grades. What is true in teaching number is equally true in other subjects. Pupils are taught many words of whose meaning they have no idea.

(a) The Montessori Plan. Madame Montessori has shown how the senses can be developed in a natural way with young children. In her "Houses of Childhood" the children are given objects to play with, which are designed to train the various sense organs. The child is then left alone, as far as possible, to work out the problem for himself. A block in which ten holes of different diameters have been bored, and ten cylinders, each fitting one of these holes, are given the child. The game is to fit the cylinders into the holes in the block, and the child soon becomes absorbed in his task, correcting himself whenever he dis-

covers an error. The above is one of many exercises given these children with different materials so selected as to afford training of all the senses.

We are not recommending that the Montessori method be introduced into our primary grades without radical modification, but we do earnestly recommend the application of its underlying principles in the transition from objects to books. This principle may be broadly stated thus: *Give the child opportunity to gain for himself by the use of objects the meaning of all the symbols he learns.*

(b) Material. The chapters on construction work, drawing, kindergarten, primary reading and language, and those on nature study, primary geography, primary history and number, all are full of directions for the selection and use of material for this purpose, and the teacher who makes a thorough study of these chapters will not go far astray in her work in sense training.

(c) Value of Indirect Training. All sense training given in connection with the regular lessons may be considered as indirect, that is, it is a means to an end, and that end is the understanding of the subject. However, this is probably the most valuable sort of sense training, since it develops the powers of observation and leads the pupil to form the habit of going about with his senses on the alert, a habit that will be of untold value, let him follow what vocation he may.

6. Direct Sense Training. The teacher will find pupils in the intermediate and grammar grades who are not keen observers. She may not be one herself. To all such, an occasional exercise which will stimulate the powers of observation is beneficial. Such exercises can be given as games or contests.

(a) Sight and Hearing. Try the following:

(1) Name the trees you can recognize by their bark. By their leaves.

(2) Name the birds you can recognize by their songs.

(3) Name the wild flowers you know.

(4) Can you distinguish pine lumber from spruce? Maple from oak? Beech from birch?

(5) Can you tell a Jersey cow from a Hereford?

(6) What is the color of a Berkshire pig? of a Duroc?

(7) How many red stripes in the United States flag?

(8) How many forms of clouds can you recognize?

(9) How does the horse bite off the grass when grazing? Does the ox bite off in the same way?

(10) How many front teeth does a cow have on her upper jaw?

These are examples of scores of questions which the ingenious teacher can prepare to set her pupils to investigating the world around them. It is usually well to give out one question at a time, and when most of the pupils have found an answer to that, take another.

The work should not become burdensome, but when properly managed it will stimulate interest in all lines of study, and lead to the gathering of much valuable information. Most of us are surprised at our ignorance of common things when confronted with tests of this sort.

(b) Taste and Smell. Taste and smell are neglected to a much greater extent than are sight and hearing, yet these senses should receive careful training. It is generally conceded that the sense of smell is one of the most potent agencies in stimulating the memory, and failure to bring these senses to a high degree of perfection deprives one of much enjoyment.

The following experiment will afford the pupils great amusement and at the same time awaken an interest in developing these senses.

Prepare 4 pieces (cubes about one-quarter of an inch long) of each of the following: raw apple, raw onion, raw celery, cooked chicken, cooked beef, cooked lamb; and have ready a half spoonful each of honey, maple syrup, molasses, cinnamon, clove and nutmeg, a medicine dropper (a plain glass rod will do) and a salt spoon or a visiting card cut lengthwise into six or seven strips.

Let the subject of the experiment be seated, with eyes closed and nose carefully plugged with cotton. Say to him, "I shall put something

in your mouth; taste it and tell me what it is before you swallow it." Require the subject to answer at once before the odor can penetrate to the nose through the passage at the back of the mouth cavity. Then place a piece, or drop, or pinch of the food, say a pinch of cinnamon, on his tongue and record his answer. Give the different substances in a mixed-up order, using each two times, and recording the substance and the answer in each case.

After these 24 trials have been made, remove the filling from the subject's nose and repeat the 24 trials.

Compare the number of errors in the two cases. Why would it be desirable to repeat the experiment on another person, testing him first with nose open and later with nose plugged?*

(c) Touch. Many authorities consider touch to be the fundamental sense. Be this as it may, it gives us knowledge that can be obtained through no other sense. The nerves of feeling reach their highest degree of development in the tips of the fingers and on the lips. The sensitiveness of those in the fingers is often blunted by misuse of the hand, and against this danger children should be cautioned. Certain occupations greatly impair the delicacy of this sense, but this cannot be avoided. What the workman loses in this way he possibly gains in some other. The stonecutter, for example, cannot judge the quality of a silk fabric by its feeling, while this is the salesman's surest method of determining quality. On the other hand, the stonecutter may be able, by laying his hand on a slab of stone, to tell what sort of finish it has received, something it would be impossible for the salesman to do.

Children need special training in the use of the sense of touch. Nice discriminations can be made only through delicate handling of the object under investigation. Children should be taught to touch objects lightly when they desire to learn the quality of the surface, and when they wish to obtain in this way an idea of the form of an object. Many exercises can be devised for this training, such as:

(1) Blindfold the pupils and let them tell the different kinds of cloth by lightly running the tips of the fingers over

* Thorndike, Elements of Psychology.

the surface. At first use fabrics easily distinguished, and gradually lead to goods of finer quality.

(2) Place a number of objects in a bag—cubes, triangular prisms, etc. Blindfold a pupil and let him put his hand in the bag and draw out an object and tell what it is. Let each pupil in the class try the experiment. At first the errors will be numerous.

(3) In place of solids use a number of common objects such as a walnut, a pecan, a small potato, an apple, etc.

(4) Try the same experiments with pieces of cardboard cut into triangles, squares, oblongs, circles and ovals.

(5) Blindfold a pupil and tell him to move his finger along the edge of your desk six inches. Measure the distance over which the finger moved. This exercise admits of indefinite expansion by using different distances. Ask the pupil to walk six feet, ten feet, etc.

7. Guiding Principles. The points discussed in this chapter may be summarized as follows:

(1) Each sense conveys to the mind knowledge that cannot primarily be obtained through any other.

(2) In order to obtain complete knowledge of an object, all the senses must be brought to bear upon it.

(3) Accurate knowledge is based upon careful and complete observation.

(4) Reason and judgment are dependent upon observation for their facts.

(5) The highest degree of perfection of the organs of special sense is attained only when sense training begins early and continues to maturity.

(6) During the early school period of this training, both direct and indirect methods should be employed.

8. Books for Teachers.

Child and Curriculum. Dewey. University of Chicago Press.

Fundamentals of Child Study. Kirkpatrick. MacMillan Company.

School Hygiene. Shaw. MacMillan Company.

Study of Children. Warner. MacMillan Company.

Elements of Psychology. Thorndike. A. G. Seiler, New York.

Education of the Central Nervous System. Reuben Post Halleck. MacMillan Company.

Apperception, or, A Pot of Green Feathers. Rooper. C. W. Bardeen, Syracuse, N. Y.

Apperception, translated by De Garmo. Lange. D. C. Heath & Co.

TEST QUESTIONS

1. What defects arise from training the sense of sight to the neglect of the other senses? Give one or more illustrations from your own observation.

2. By what mental process are you able to recognize a person by his voice, a bell by its sound, or the quality of a fabric by its effect on the sense of touch? Give one illustration.

3. What is your plan for detecting defective hearing? For detecting defective sight?

4. Show why the senses are best developed through the regular school exercises.

5. Show how keen observation assists one in reasoning.

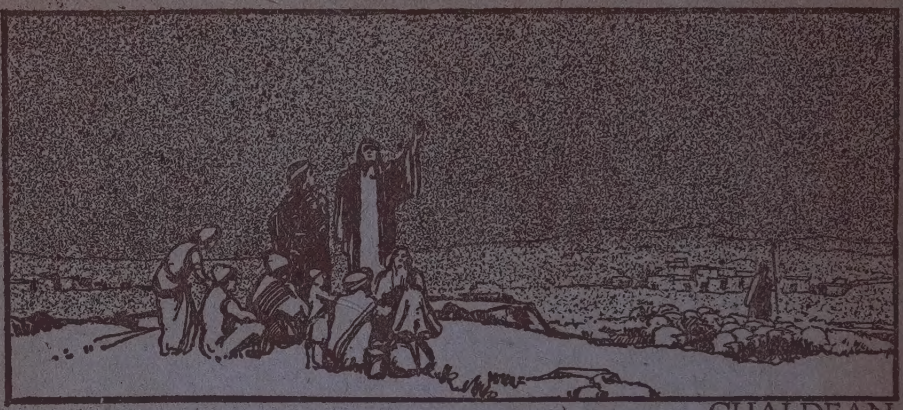
6. What school exercises do you consider best for training the powers of observation? Give reasons for your answer.

7. In what way do games aid in training the senses? Give a specific illustration.

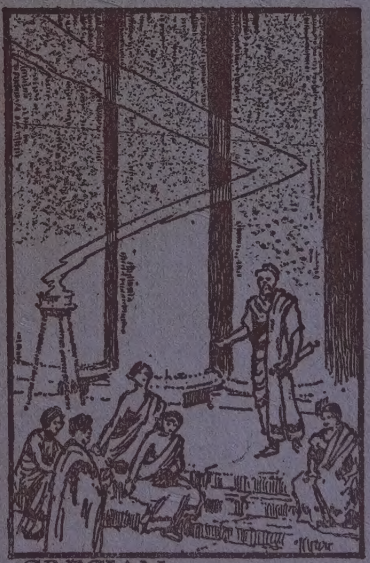
8. What is the relative value of the sense of touch compared with the sense of hearing? Compared with the sense of sight?

9. Why does fatigue affect the activity of the senses? Of what value is a knowledge of this fact to the teacher?

10. Which do you think the more advantageous for developing the powers of observation, the city or the country? Give reasons for your answer.

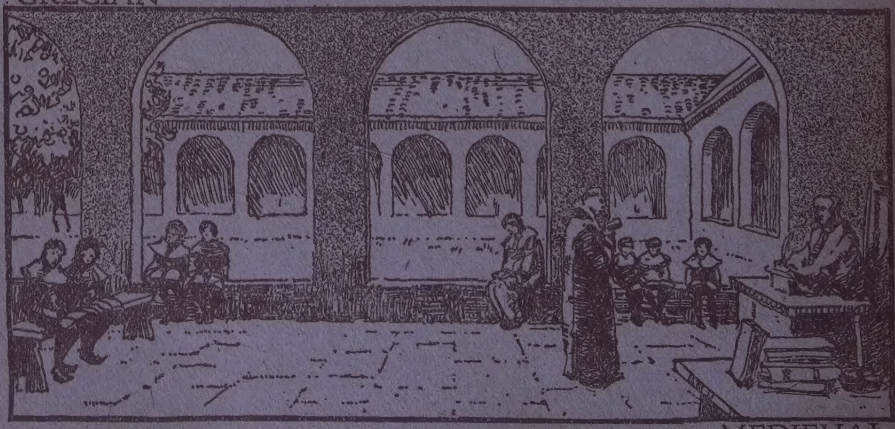


CHALDEAN

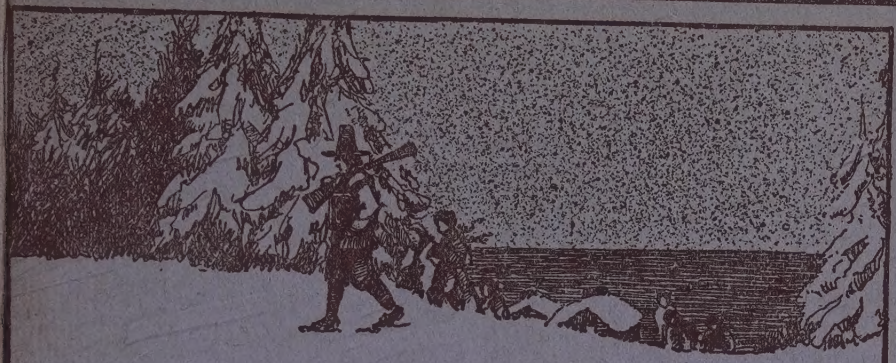


GRECIAN

THE FATE OF EMPIRES
DEPENDS UPON THE
EDUCATION
OF YOUTH
ARISTOTLE



MEDIEVAL



COLONIAL

THE SECRET OF EDU
CATION LIES IN RE
SPECTING THE
PUPIL

EMERSON

PIONEER

MODERN

T.W. STEVENS